HEATING & VENTILATING
AIR CONDITIONING

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FOR FEBRUARY, 1937

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For Engineers and Contractors Controlling the Design, Specification, Installation and Maintenance of Heating, Ventilating and Air Conditioning.

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Pump illustrated is the new Jennings Vapor Turbine Return Line Heating Pump. It operates directly from the system steam and requires no electric current. It insures absolutely uniform system circulation, and promotes steam economy. One moving part. Bulletin 246-A gives the facts. Send for your copy.

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SOUTH NORWALK, CONNECTICUT, U. S. A.

Hospital Conditioning System Gives Wide Variety of Climatic Conditions

A NEW departure in hospitalization, which will afford an unequalled opportunity for the cooperation of the medical and engineering professions in studying the effects of air conditioning in the treatment of various diseases, is presented in the recently air conditioned Corey Hill Hospital, atop of famous Corey Hill, in Brookline, Mass. The Corey Hill Hospital is completely year-round air conditioned.

Not only the operating rooms and adjoining suites have been air conditioned, but also each of the 60 private patients' rooms, with a system that is calculated to supply practically any climatic condition desired for the varying needs of the different patients from day to day.

It is possible to supply optimum climatic conditions for each patient separately, through automatic controls in each of the rooms, and to reproduce the beneficial effects of clean air in any climate without such detrimental qualities as dust, pollen, and intense heat or high humidity.

The Corey Hill Hospital specializes in cases of arthritis and rheumatic fevers, and its director, Dr. Albert K. Young, states that in deciding upon the type of air conditioning to be installed, his first task was to determine what range of temperature and what relative humidity would be most beneficial for the patients. Because of his interest in arthritis and rheumatic fevers, he had approached the study from the standpoint of patients suffering from those diseases. By a careful study of climatic conditions in those regions known to be most beneficial to such sufferers, he learned that a relative humidity of between 25 and 35% was the most ideal.

As his study continued, however, he realized the importance of controlling the same factors in the care of patients suffering from many other diseases, and therefore decided that the air conditioning should be extended to the entire hospital, rather than be confined to a few rooms.

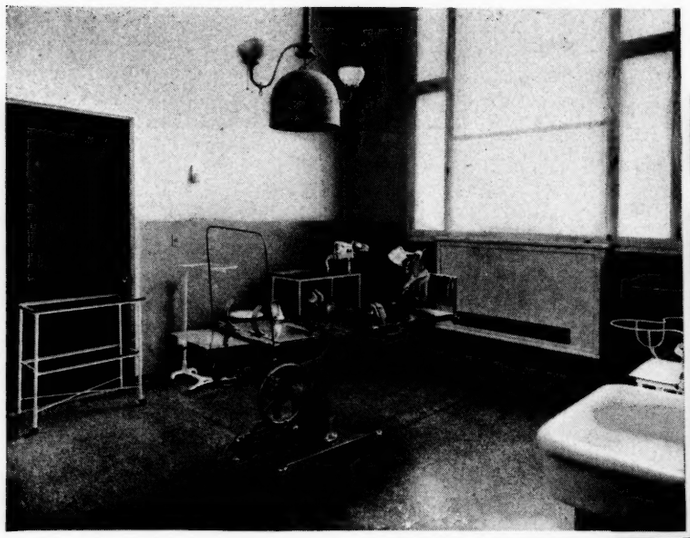
In view of the fact that each individual has his own ideas as to what is a comfortable temperature in a room, it was decided that temperature control must be made available separately for each room, and that because a higher humidity is advantageous for some conditions, and a lower humidity is required by others, it would also have to be possible to vary the humidity separately in each room. Consequently, each room is an air conditioned unit in itself, with provision for adjustments to suit the requirements of the patient occupying that room. So this system provides for year-round control of all air conditions, including temperature, humidity, and air movement.

In the winter the temperature and humidity can be kept at such levels as appear advantageous for arthritic and rheumatic patients in climates like those of Arizona or Florida. In the summer, regardless of what the outside temperature may be, that within the hospital will not exceed 80F and the relative humidity will not exceed 30%. This contrasts with conditions prevailing in the middle west last summer, when room temperatures often reached 108F, and surgeons had to operate under terrific handicaps.

Doctor Young does not consider air conditioning a

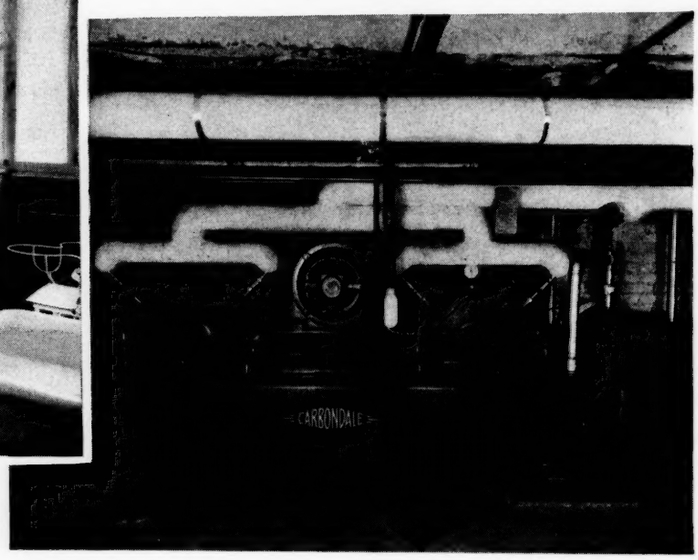
Air Conditioning The Corey Hill Hospital

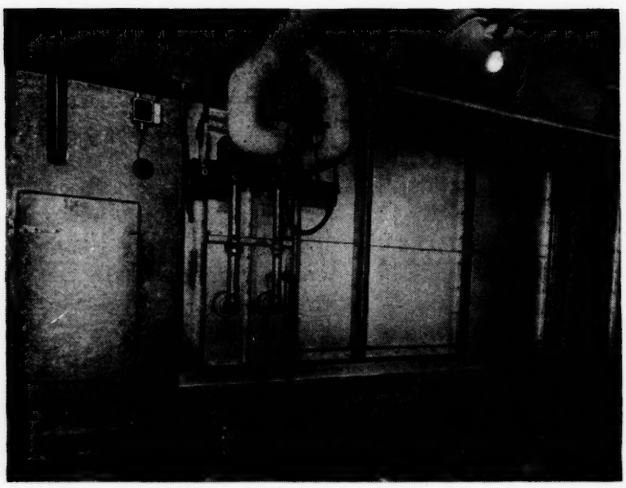
A combination mechanical cooling and lithium chloride dehumidifying system is employed to condition the air in the Corey Hill Hospital (right). Such a system is necessary because of the unusual conditions maintained.

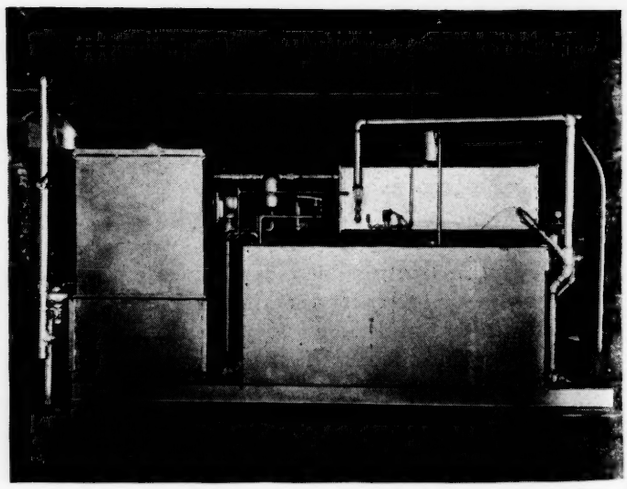


(Above) On the walls of this operating room can be seen one of the air conditioning units which mixes the conditioned air with room air before discharging it into the room.

(Below) 25-hp. double condensing unit which is used for cooling the hospital air during the summer.







(Left) The Kathabar contactor which is used to dehumidify the hospital air and which utilizes lithium chloride (Kathene) as the dehumidification agent. (Right) Kathene economizer and storage tank. At the left is gas boiler which is used to reconcentrate the Kathene liquid.

cure-all for every ill, but does feel that it is an adjunct to hospital treatment that will make possible giving the patient the best known in the way of climatic environment and add to his general comfort. Thus the normal physiological processes are given better opportunity to function.

The System

Two important requirements had to be met in designing this system. First, no general recirculation could be allowed. Second, inasmuch as the hospital is devoted principally to arthritic and rheumatic fever cases, low relative humidities in the summer are necessary. After considerable research it was decided that the most efficient type from the standpoints of both first cost and operating cost would be a combination of liquid absorption, mechanical refrigeration, and local recirculation.

A gravity exhaust in each patient's room and a fan exhaust in each operating room prevents recirculation of air generally throughout the hospital. Also any possible dissemination of odors or air-borne infections is thus prevented.

The system in general is of the central station type, consisting of a lithium chloride (Kathene) contactor, dichlorodifluoromethane compressor, blending unit, Kathene cooling shell and chilled water tanks. Air is drawn through a dry filter from outside, and in winter passes over heating coils, thence over or through a lithium chloride contactor. The lithium chloride, very susceptible to moisture, becomes diluted and helps to humidify the air in winter. In summer, the concentrated solution effects removal of the moisture from the air, dehumidifying it. The contactor is a large steel tank holding a perforated plate from which hang a countless number of strings. Through the perforations and down the strings the lithium chloride drips, the strings forming a huge blanket through which the air passes to a cooling coil and also to the fan intake.

Sensible cooling is by means of a 25-hp. compressor of the 8-cylinder twin V type. There is no direct expansion. Chilled water is used for secondary refrigeration. Fin type coolers are supplied with refrigerated water from a storage tank, the water being automatically controlled so as to get varying temperatures through the coolers as determined by thermostatic controls for the three different zones.

Highly cooled and dehumidified air (in summer) or properly warmed and humidified air (in winter) is passed through ejector type local recirculating units in each room, reaching them by means of built-in ducts. In the recirculating units, placed under the windows, room air is mixed with the conditioned air before being distributed into the room. These local units also have a fin type heater, operated by an individual room thermostatic control.

In the sub-basement is a gas fired boiler, separate from the building's steam plant, that is used to boil out the moisture from the diluted lithium chloride. When reconcentrated, the liquid runs down into a chloride tank. The vapor rising from the boiler is passed through an economizer which removes the remaining lithium chloride, the water vapor left being condensed and passed off as waste. Chilled water in a steel shell, flowing around coils, cools the lithium chloride before it is returned.

By this system it is possible to use a small station unit supplying only the amount of air required for ventilating, with a minimum use of refrigerant and at the same time providing a sufficient quantity of air to do the necessary cooling. It also allows for properly removing the moisture from the air without overcooling and making it necessary to reheat for comfort. It is said to be economical in the consumption of water, lithium chloride, and the gas for firing.

Cooling and Air Conditioning Corporation was the air conditioning contractor.

British Test Air Conditioned Railroad Car for Use in Tropics

AN unusually interesting demonstration under artificially created tropical conditions, of the air conditioning of railroad cars was given recently at the Birmingham Railway Carriage and Wagon Works, Smethwick, England. The car tested was one of the first air conditioned vehicles produced in Britain.

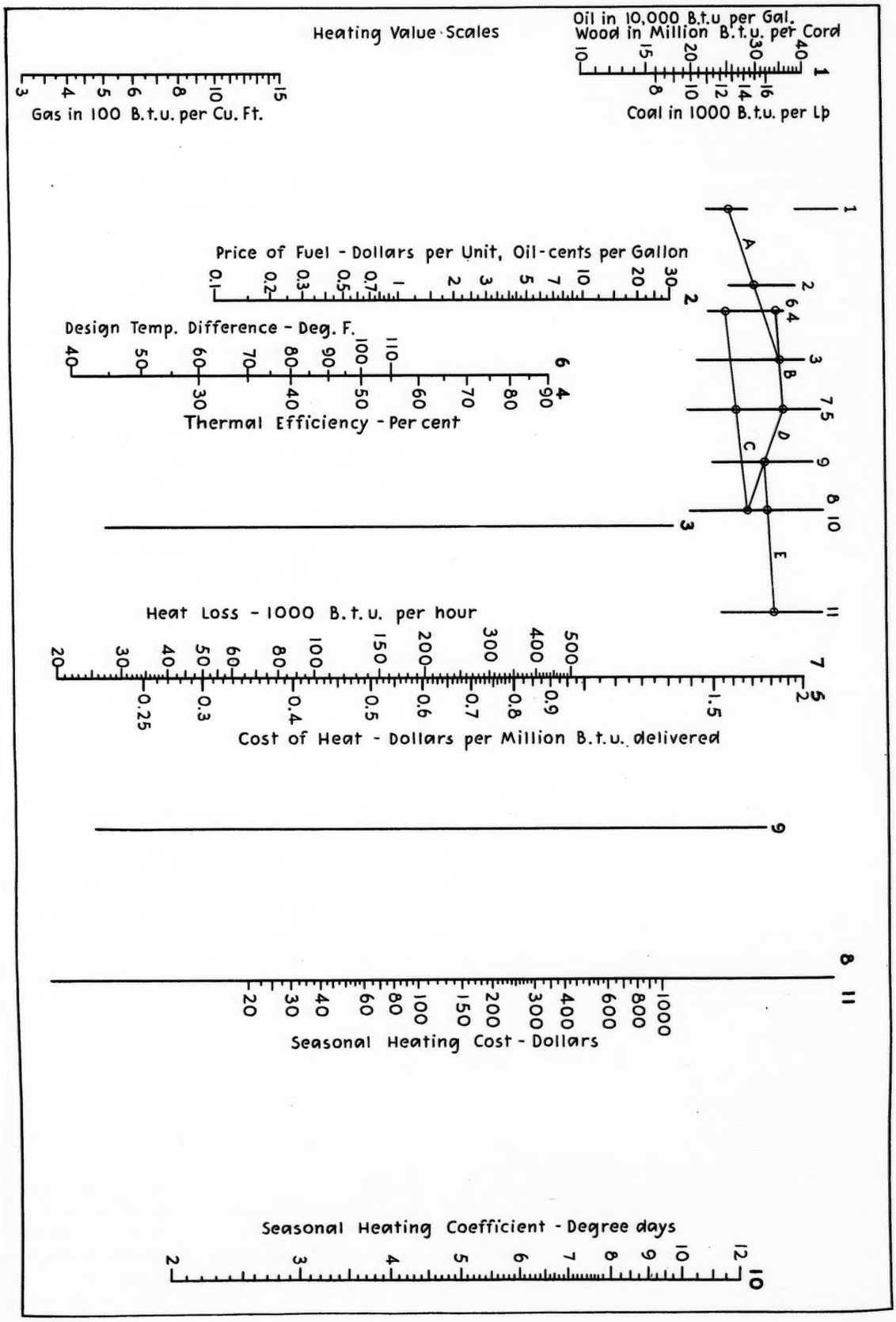
Inside a test enclosure a passenger car of special design built for the Federated Malay States Railway had been placed for inspection. The temperature in the enclosure was raised to about 92F, while a humidity percentage of 70F made the air clammy and oppressive. The car comprised two large saloons having seats for 12 and 8 passengers, respectively, and a small four-seated compartment. In each of these cars the temperature was constant at 72F, humidity was reduced to 56%, and the air was fresh and clean. Because of the manner in which the car is insulated, outside noises were excluded, a factor which promised comparatively silent travel.

The purpose of the demonstration was to show that in tropical countries, or those where heat and dust are common, railroad travelling can be made comfortable, clean, and free from draft at all seasons of the year.

In the new cars for Malaya, fresh air, drawn through louvers in the vestibule doors, passes up through a grille in the vestibule ceiling and, after the dust and dirt have been extracted by means of viscous oil filters, is taken over the cooling coils of an evaporator, where a proportion of the moisture in the air condenses on the cold surface. At the same time the temperature is reduced to the required level according to the setting of the thermostatic control. The air is then drawn into twin centrifugal fans and forced through ducts located in the double roof, and passes into the compartments through grilles which provide even distribution without drafts throughout the vehicle. A portion of the air escapes owing to the slight pressure produced by the fans, and the remainder returns through grilles in the partitions at floor level to the vestibule end and up to the roof beyond the control panel, to be recirculated.

A Degree-Day Alignment Chart†

By J. DONALD KROEKER‡


Heating Value Scales
Gas in 100 B.t.u. per Cu. Ft.
Oil in 10,000 B.t.u per Gal.
Wood in Million B.t.u. per Cord
Coal in 1000 B.t.u. per Lb
Price of Fuel - Dollars per Unit, Oil-cents per Gallon
Design Temp. Difference - Deg. F.
Thermal Efficiency - Per cent
A
B
C
D
E
Heat Loss - 1000 B.t.u. per hour
Cost of Heat - Dollars per Million B.t.u. delivered
Seasonal Heating Cost - Dollars
Seasonal Heating Coefficient - Degree days

THE complete rational formula for computation of heating costs is solved graphically by means of the accompanying alignment chart. It is universally applicable in that it provides for computation on the basis of any fuel at any price used in an appliance of any efficiency to offset any heat load at any given seasonal heating coefficient or degree-day.

The rational formula for seasonal heating cost may be stated as

$$C = 24 \frac{H \times D \times P}{t_d \times V \times E}$$

In which

C = Seasonal heating cost for the average heating season.
H = Heat loss from the building in B.t.u. per hr.
P = Price per unit of the fuel in dollars.
D = Seasonal heating coefficient in degree-days for the particular locality.
t_d = Design temperature difference in °F on the basis of which the heat loss was determined.
V = Total heating value of the fuel in B.t.u. per unit.
E = Thermal efficiency of the heating appliance and the system expressed as a decimal.

Using the chart, the heating cost is found in two operations; namely, first the cost of heat per million B.t.u. delivered is found, and secondly, the seasonal heating cost is determined.

If one is dealing always with one fuel at one price used in one type of system, so that the efficiency is not a variable, a "cost of heat" figure may be found in the first operation which is a constant, and then only the second half of the chart need be employed for further computations.

The chart is aligned according to the key shown in the upper left; namely, according to the numbers of the scales. Simply stated:

A—Align scales 1 and 2 and hold line 3;
B—Align point on 3 with scale 4 and read scale 5, the end of the first operation, obtaining "cost of heat."
C—Align scales 6 and 7 and hold line 8;
D—Align point on 8 with scale 5 and hold 9;
E—Align point on 9 and scale 10 and read 11, the "seasonal heating cost."

For example, the heating cost is required for a structure having a heat loss of 100,000 B.t.u. per hr. based on a temperature difference of 60F in a locality where the seasonal heating coefficient is 5,000 degree-days. Five-cent oil is used having a heating value of 140,000 B.t.u. per gal. and the overall thermal efficiency of the heating system is 65%. We find, by using the above formula, that the average seasonal heating cost is $109.80.

By means of the chart we find this by aligning 14, the heating value of oil in 10,000 B.t.u. per gal., on scale 1 with 5, the price of oil, on scale 2, to obtain a point on line 3. Holding this point we find the efficiency, 65%, on scale 4, and aligning this we read 55 cents, the cost of heat per million B.t.u. delivered, on scale 5.

Now, on scale 6 we find 60F, the design temperature difference, and align this with 100 on scale 7, the heat loss in 1,000 B.t.u. per hr., obtaining an intercept on line 8. We align this with 55 cents, obtained above on scale 5, to obtain a point on line 9. This point is now aligned with 5 on scale 10, the seasonal heating coefficient in 1,000 degree-days, and on scale 11 we read the seasonal heating cost; namely, $109.

Using the first part operation only, a convenient means is provided to make a comparison of heating cost without consideration of the structure or the locality, but having in mind only fuels, prices of fuels, and efficiencies.

†Honorable mention, HEATING & VENTILATING's Degree-Day Competition.

‡President, Columbia Engineering Co., Portland, Oreg.

Purifying Air With Mercury Tubes

A 50-WATT mercury lamp has a "killing power" sufficient to purify 10,000 cu. ft. of air per minute, according to Dr. William F. Wells of the Harvard School of Public Health. He spoke recently at the six-day symposium of the Harvard school, telling of several unusual experiments with the germs of such diseases as the common cold. He suggested that such mercury lamps may soon be installed in the fresh air intakes of public building and office ventilating systems. "Sneeze tests" applied to 25 Harvard students prove the need of purifying the air supplied to public buildings in much the same way that drinking water is purified, he said. Six students were made to sneeze fifty times by giving them sneezing powder. The air from their lungs, expelled in the sneezing was found to contain countless nose and throat germs. In continuing his lecture he demonstrated how these germs are spread from one person to other occupants of a hall, by means of a machine known as an "air centrifuge," placed at the front of his classroom. This machine blew out air just as would a person afflicted with a common cold. Indication that these fine particles were being circulated in every part of the room was not long in becoming unmistakably clear, for in a few minutes most of the students were sneezing violently. Research conducted at Harvard during the past five years has convinced experts that the next advance in public health may be made by systematic purification of the air supply of public buildings. He then explained how an ultra-violet light may be used in purifying the air.

School System Uses Degree-Days to Reduce Fuel Consumption‡

By H. K. KUGEL†

THE use of the degree-day was first inaugurated in the Cleveland Public School System at the close of the 1932-33 heating season. There are some 150 buildings in the system and it was desired to find a means of comparing the annual coal consumption of the various buildings. This would give the custodian in charge an opportunity to compare his building with any other similar building and to determine whether he had made an improvement over previous years. In other words, it would put them on a more or less competitive basis, bringing all records out for everyone to see and compare.

An annual report was started in 1932-33 dividing the buildings into three groups: high schools, junior high schools, and elementary schools. Each building in its group was listed according to area, that being the basis on which school costs are figured in Cleveland. The smallest school was at the beginning and the largest at the end of the list. This made it possible to compare easily buildings of about the same area and also to compare any one with the average of the group.

The report showed the name of the building, the square foot area, tons this year, tons last year, change tons, change per cent, tons per 1000 sq. ft., and pounds per degree-day.

The 1933-34 report added a final column of "pounds of coal per 1000 sq. ft. of floor area per degree-day." This figure enabled a comparison to be made of any size building with any other building for any year or with itself for any period.

In 1934-35 a new feature was developed by making monthly comparisons of the pounds of coal per degree-day for groups of buildings having the same kind of boiler room equipment, such as underfeed stokers, cast-iron, down-draft boilers, etc. This enabled a custodian to get a comparison of his building with others before the end of the year, but this was too much work.

As a result of this a form was developed in 1935-36 and sent out to all schools to enable each custodian to keep a running monthly record of his own operation.

A partial report for one school is shown herewith. This report also affords a comparison of a new firebox boiler with an underfeed stoker as against an old H.R.T. boiler with a V-type stoker.

The total coal used for the entire system was reduced each year, the comparison being shown by 1.81 lb. per 1000 sq. ft. of floor area per degree-day for 1934-35 as against 2.24 lb. for 1931-32, a reduction of 19.3%.

†Smoke Regulation Engineer, Government of the District of Columbia.
‡Honorable mention, HEATING & VENTILATING's Degree-Day Competition.

Mayflower SCHOOL 1935-1936

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MONTH	TONS USED				MONTHLY DEGREE DAYS			TOTAL DEGREE DAYS			POUNDS PER DEGREE DAY			
	This Month	TO DATE This Year	TO DATE Last Year	Change Per Cent	This Year	Last Year	Change Per Cent	TO DATE This Year	TO DATE Last Year	Change Per Cent	This Month	TO DATE This Year	TO DATE Last Year	Change Per Cent
SEPT.	0	0	0.5	—	94	57	+65.0	94	57	+65.0	—	—	—	—
OCT.	13.75	13.75	14.5	-5.1	341	349	-2.3	435	406	+ 7.1	81	63	71	-11.2
NOV.	27.50	41.25	40.5	+1.8	644	539	+19.5	1079	945	+14.2	86	76	85	-10.6
DEC.	35.00	76.25	80.5	-5.2	1180	1053	+12.1	2259	1998	+13.0	59	67	80	-16.2
JAN.	43.00	119.25	144.5	-17.2	1279	1119	+14.3	3538	3117	+13.5	69	67	92	-27.2
FEB.	41.00	160.25	196.5	-18.4	1275	1019	+25.1	4813	4136	+16.4	64	66	95	-30.5
MAR.						679			4815					
APR.						612			5427					
MAY						327			5799					
JUNE														
TOTAL			282			5799			5799				99	

4. = Diff. between 2 and 3÷3
7. = Diff. between 5 and 6÷6
10. = Diff. between 8 and 9÷9
11. = 1 x 2000÷5
12. = 2 x 2000÷8
13. = 3 x 2000÷9
14. = Diff. between 12 and 13÷13

Numbers refer to columns.

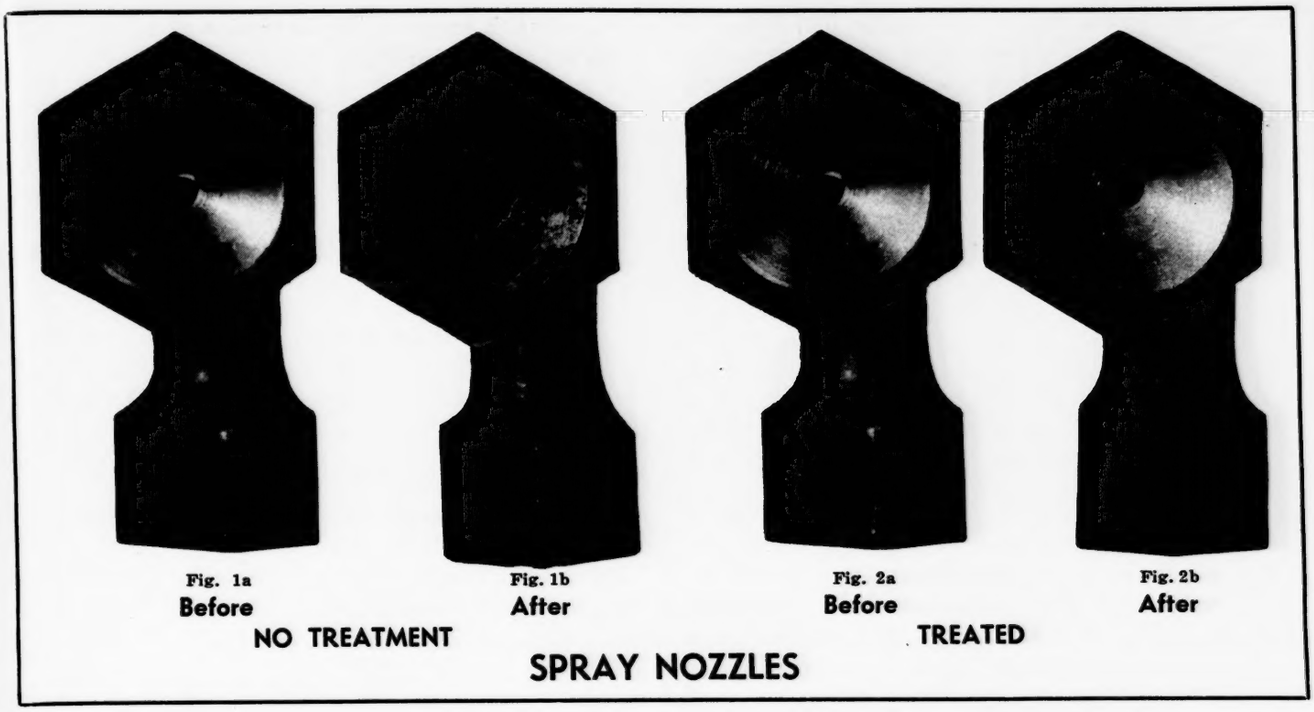


Fig. 1a Before — Fig. 1b After — NO TREATMENT

Fig. 2a Before — Fig. 2b After — TREATED

SPRAY NOZZLES

Water Treatment Prevents Corrosion in Spray Chambers

By ERNST A. RUTH, Jr.†

INCREASING use of air conditioning in industrial plants and office buildings is continually presenting new problems of maintenance. But the problem of corrosion in spray chambers caused by the recirculated water deserves the serious thought of operating and designing engineers. Seldom do the operators of air conditioning equipment realize the importance of this vital detail and unless water treatment is installed with the original equipment they do not consider its necessity until corrosion has started.

This is not surprising when one considers that a spray chamber seems to be very simple in construction, constantly visible and hence easily inspected. But a spray chamber, the heart of the air conditioning system, uses water to accomplish its results. Any one who has had experience with the circulation of cooling water to water cooled machinery or with boilers knows how corrosion may progress unseen from apparently pure water.

Spray chambers corrode under the same influences but more quickly than heavier types of water cooled machinery. Here is a constantly recirculated water supply through which is passing a constant flow of air. This air, depending on the locality, is more or less contaminated with the products of combustion, such as, combined sulphur, CO, CO_2,—plus dust and other foreign matter.

These are definitely active chemically. The sulphur compounds will form sulphurous or sulphuric acid, the CO_2 will form carbonic acid. As the spray water is recirculated these compounds are continually absorbed into solution from the air until the water has a surprisingly high acidic concentration. As an example, in New York City a spray chamber handling 30,000 c.f.m. was filled with fresh city water. This water when tested after 16 hr. recirculation had a pH value of 5.0.

Corrosive action by water is accelerated by the following conditions:

1.—Velocity of flow; 2.—finely divided water particles as found in a spray system; 3.—definitely acid in character; 4.—ample supply of oxygen.

The first two of these factors are inherent in a spray chamber. The third and fourth are obtained from the influent air. All are working in perfect coordination, each factor doing its bit to form the metallic salt or oxide which action is known as corrosion. The result is a rapid corrosion of the walls of the chamber, the spray nozzles; the piping and pressure pump; the eliminator plates and, possibly, the duct system.

Construction of the spray chamber is such as to be quickly acted upon by the combined forces causing corrosion. They are usually

As a result of experience in the operation of a large air conditioning plant, the author feels that water treatment to prevent corrosion should be put in as a part of the original equipment. He believes that in future plants using air washers such treatment will be insisted on for the benefit of all concerned.

†Mechanical Engineer, Maplewood, N. J.

built of galvanized iron or copper, the first being the more common material. The latter material is used to combat corrosion, but in a spray chamber its purpose may be defeated. Copper is anti-corrosive in virtue of the fact that reacting chemically with the surface medium, it forms a partially impervious surface coating which delays, or entirely inhibits, corrosive attack under this protective coating. In a spray chamber the continuous washing action of the sprays does not allow this protective coating to form. Instead, as quickly as it is formed the spray action washes it away. Likewise galvanized iron under spray action may have its protective surface quickly destroyed, leaving the thin iron sheet at the mercy of the corrosive spray action.

As corrosion occurs in the spray chamber superficial correctives, such as painting, are usually resorted to in an attempt to stop its progress. In fact, each installation when installed may be coated with a protective paint on its interior surfaces. This at best gives little protection, is only a temporary measure, and may destroy the means of detecting extensive corrosion. The paint so applied soon develops small invisible hair cracks which admit the water, under spray velocity, to the metal quite unnoticed by the closest visual examination of the paint surface. Once in contact with the metal the water proceeds to set up corrosive action. As the corrosion progresses the paint cracks enlarge, at the same time breaking the bond of paint to metal. The paint loosens on all sides and finally chips off exposing the metal. Often, however, the metal corrodes through before the paint chips off. The operator is surprised to find holes showing through the metal on the outer surface, while the paint on the inside surface may be intact and unbroken.

Corrosion will attack the interior surfaces at all points in contact with moisture, but this action is most severe at the points of direct water impingement on the chamber walls, before the water is completely broken up into spray.

Effect of Corrosive Water on Nozzles, Pump, and Piping

Any alteration of the designed form of the spray nozzles by enlargement of the effluent hole or cutting of the body will reduce the efficiency of this equipment, giving a sloppy spray and requiring excessive pressure to atomize. Of course normal erosion will in time accomplish this and it is expected that these nozzles may have to be renewed after a run of 3,000 hr., with water of good quality. With water of corrosive nature, experience has shown that the nozzle hole may be enlarged to twice its original diameter in 600 hr. The nozzle bodies may be badly cut in the same time. The enlargement of nozzle holes may first manifest itself by requiring increase of pumping pressure to obtain proper spray. Further examination may then show such a condition as exists in Fig. 1b.

The pump and its piping is affected along with the rest of the equipment. In chemical plants pumps and piping of special materials are used to convey acids. But with water definitely acid from a spray chamber the pump and piping are made of materials usually used in pumping fresh water. Such material is happy hunting ground for corrosive water.

Results Observed in the Operation of a New Conditioning Plant

Operation of an air conditioning installation in New York, which was observed by the author, definitely proved that an effective and sure method of combating corrosion is the proper treatment of the recirculated water. The operation of this plant without treatment at the start demonstrated the destruction possible where water treatment is not installed as part of the original equipment.

A brief description of the equipment is given and the operating results with and without treatment of recirculated water are discussed as of interest to all those operating air conditioning systems.

Description of Installation

In this installation there are seven spray type dehumidifiers and three spray type air washers. These vary in size from 20,500 c.f.m. to 54,000 c.f.m., the total capacity being 375,000 c.f.m. Each washer is a unit, individual circulating pumps supplying water to the sprays. The dehumidifiers are constructed of galvanized sheet, covered on the outside with cork insulation and on the inside surface are given a coating of anti-corrosive paint. The washers are constructed of copper without insulating covering and are not painted on their interior surfaces. The bottoms of the spray chambers form the circulating tanks with an average capacity of 400 gal. Spray nozzle bodies are of cast brass. Spray caps are also of brass with a heavy chromium plate, and are renewable. Spray headers and risers are of wrought iron pipe. The circulating pumps are of 350 g.p.m. to 850 g.p.m. and are constructed of cast iron, except the impellers which are of bronze composition. These pumps give continual recirculation of the water from the tank to the spray nozzles, that water which is lost by evaporation during winter operation is made up by a float valve on the city water supply; during periods of dehumidification the excess water is run to sewer.

Plant Operated without Treating Spray Water

The plant was operated for a period of 80 days without treating the water in any way. The only attempt made to keep the water in a proper condition was to drain the recirculating pumps and wash out the sediment about every three days. Corrosive action on the walls of the spray chambers was noticed almost immediately after operation had started.

The metal was attacked first where the paint was chipped off or thin. As these points showed themselves in the dehumidifiers they were touched up with an asphaltum paint. This treatment failed to stop the progress of the corrosion as it soon became apparent that corrosion was progressing under the covering of paint. The action was most pronounced at the points where spray water impinged directly upon the walls before being completely atomized. The washers were equally affected along with the dehumidifiers.

Soon after the beginning of operation erosion was noticed in the holes of the spray caps. This advanced rapidly, and at the end of 50 days of operation the spray water had eroded the holes until many of them

were increased to twice their original diameter (see Fig. 1b). It was impossible to maintain the normal spray pressure of 25 lb. per sq. in. at the nozzles even after opening the regulating valves full. Examination showed that the interiors of the nozzle bodies were also eroded at the point where the water receives its whirling motion (see Fig. 3b). After 50 days' operation it was necessary to renew all the spray caps and many of the nozzle bodies in order to obtain proper atomization.

With these new nozzles installed the equipment was operated for the remaining 30 days. During this period the water was changed three times weekly instead of twice weekly as before. But in spite of this added precaution and frequent painting the corrosion persisted. Those areas of some of the walls receiving direct spray impingement, in spite of continual painting, were finally corroded through in a series of small holes corresponding to the direction of the spray impingement. The metal surrounding these holes flaked off when touched and gave every evidence that the corrosion would spread to larger areas and that eventually the whole of the interior would be in this condition.

One of the most interesting conditions was found when the circulating pumps were opened. The interiors of top and bottom casings were found to be badly corroded. Corrosive action had dissolved the cast iron leaving a spongy deposit on the interior surface which extended to a depth of ⅛ in. This deposit was scraped off to the good metal and the pumps were reassembled without further treatment.

Plant Operated with Spray Water Treated

After this period of 80 days' operation a system of water treatment was decided upon and installed. With this treatment in service it was soon indicated that corrosion was being arrested. In order to compare fairly the operation with and without the treatment, the plant was operated for another 80-day period in the same manner as before with the exception that the water was changed but once a week and then only to clean out the sediment in the tanks.

Results of Water Treatment

Inspection at the end of that period failed to show that the metal of the spray chambers had suffered corrosion. The walls appeared in excellent condition, even those areas where the paint was chipped off showing no signs of corrosion. The nozzles gave the most striking evidence of the positive results to be obtained by the use of water treatment. Fig. 1b shows the results of corrosion on the spray caps after they were in service for 50 days (500 hr.) without treating the water. Compared to the spray cap shown in Fig. 1a, which is new and unused, it is readily seen that the corrosive action of the water was extremely destructive to the nozzles.

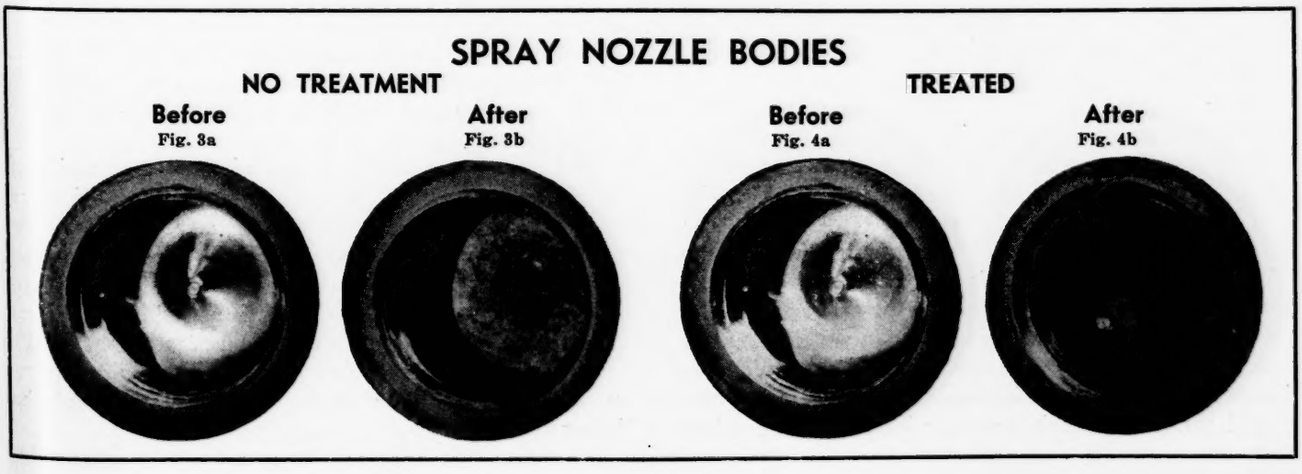
It is easily understood that proper atomization is impossible with caps in the condition shown in Fig. 1b. Fig. 2b shows the results when using treated water. This nozzle was in operation for 80 days and it cannot be distinguished from a new nozzle. Figs. 3 and 4 show results obtained on the nozzle bodies. Note how corrosion has cut into the base of the whirl cone, Fig. 3b.

Pumps were opened up after the water treatment had been in use for three months. They showed no signs of corrosion, which was remarkable when compared to the condition found at the previous inspection. They were reassembled, with no repairs necessary.

Discussion of Results

The results obtained in the operation of this plant show that proper treatment of the circulating water is a necessity to protect air conditioning equipment in contact with this water. These results present themselves most forcibly when considered in the light of dollars and cents. Remember that this equipment was operated without treatment under normal conditions for the locality, for a period of 80 days. At the end of that time the following repairs had been made: a full set of spray caps had been installed to replace those badly eroded; about half of the nozzle bodies were renewed; it was necessary to completely renew the walls in two dehumidifiers and to patch the walls of most of the other units; the circulating pumps had been opened and scraped clean. These repairs and replacements indicated that it would be necessary in one year to: replace spray caps three times; replace nozzle bodies twice; completely rebuild the equivalent of five washers or dehumidifiers; practically replace the pump casings.

The cost of these repairs and replacements is immediately evident. As this equipment was operated during the winter months without water treatment the



refrigeration piping to the dehumidifiers was not used under these conditions and no data are available as to the extent of corrosion in this piping when operating. Undoubtedly, the damage would be extensive. The cost of the water treatment is indeed small when the cost of the probable repairs is considered and the ratio can be very conservatively estimated as one to ten.

And the saving will be not only in dollars but will be found in the comfortable assurance that the equipment will always operate at its fullest efficiency and without the ever present possibility of an outage.

Suggestions for Operating a Treatment System

What type of protection is necessary? Refer again to those factors accelerating corrosion. Factors one, two, and four we cannot alter. The third factor, however, is subject to control. If we can change this from an acid to an alkaline condition of fairly high pH, then with proper supervision our troubles are practically over. With the acidic factor out, the remaining corrosive factors do not work in a congenial medium. The factor of normal erosion is ever present and is subject to control by routine maintenance. Destruction by normal erosion will be taken care of by the normal maintenance budget.

Any system of treatment, and there are several on the market, must be properly applied and will require the constant supervision of the operator to assure its successful application. The application of the various patented treatments will usually be supervised by representatives of the company after installation. In fact, the contract usually provides for this service. Usually, the chief difference between the systems is the patented method of proportioning the introduction of the chemical into the water. Proper introduction is important as there should be a quantity of chemical added which will keep the water in an alkaline condition between proper pH values. The chemicals used although usually clouded in a veil of secrecy are important only if they accomplish the desired results without in themselves being corrosive. Most plants having a chemical laboratory will be able to make up their own chemical to maintain the buffering effect desired.

For introducing the chemical the author is familiar with a small chemical pump operated on the principle of a pressure lubricator and made by a well known lubricator company. The pump will deliver to three lines at one time and the amount delivered can be accurately controlled. Although the author has never seen the application of this type of chemical feeder to air washers, they are being used with great success on boilers, and could with no change be adapted for use on air washers.

Frequent tests of the water are necessary; at least twice a day and preferably once an hour. Of course, normal cleaning of the pump to remove mud must be done as often as the particular locality demands, and the water probably should be renewed each week but may run longer if conditions warrant.

To test the water all that is required is a pH color comparator of any reliable make. The pH values to be maintained will be decided by the operator. However, a pH below 9.0 is normally too low unless conditions show that corrosion can be controlled at this value. Neither should the pH go above 12.0. Too high alkalinity will cause incrustation around glands, valves, and fittings. The deciding values will be arrived at only by careful, constant observation.

Conclusion

In the author's opinion future air conditioning systems with spray chambers must have some means of treating the recirculated water as part of the original installation. The manufacturer will insist that the water be treated to insure the maximum life of his equipment.

Whether the conditioning of the water is done by the plant itself or a contract is let to a firm specializing in this work, the importance of this conditioning should be definitely recognized and provision made to include it in the original installation. Such care will save much money and outage equipment. Let us adopt the slogan—"Condition the water that conditions your air."

Glycerine Used to Remove Boiler Scale

The problem of boiler scale formation at one time or another confronts practically every heating and power system operator. Clearing it out means time and trouble. To prevent or retard the formation, and thus eliminate this item of overhead, glycerine has been found useful.

The power of glycerine as an almost universal solvent is largely the explanation of its efficiency in this usage. The boiler scale formation is caused primarily by the presence of the lime salts in the water in the boiler. The addition of glycerine acts to increase the solubility of the lime salts, forming soluble compounds.

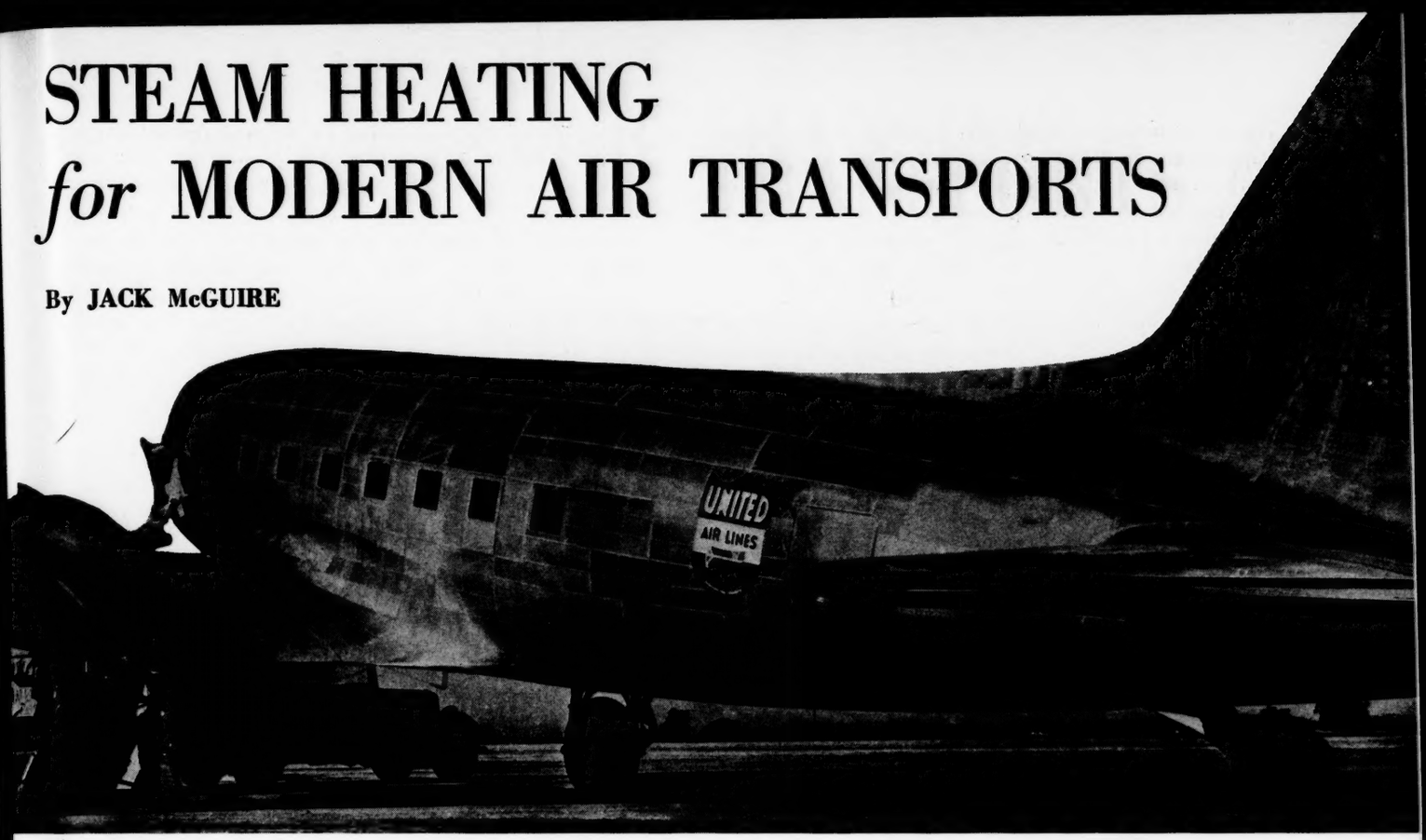
The lime concentrations in the course of time will become too large to be assimilated in this way by the formation of soluble compounds, but as this happens, a viscous, gelatine-like substance is precipitated which has the advantage of not adhering to the surface of the iron plates. Moreover, it is not carried into the cylinders of the engine or to radiators by the action of the steam.

No complicated apparatus is involved in this use of glycerine to prevent scale formation, nor is it necessary to work out any complicated formula. Figuring proportionately to the amount of coal used in firing the boiler, practical experience has shown that satisfactory results are obtained simply by adding 5 lb. of glycerine to the water for each ton of coal.

In this connection the report of the recent series of authentic tests of the effect of scale in cutting efficiency is of interest. In 120 tests, 11% greater output was obtained from steam engines during a single month after the boilers were freed from scale than was obtained during the three months' period before they were cleaned. When boilers are operating at heavy loads, especially, scale formation is often directly responsible for the overheating and burning out of the boiler tubes.

STEAM HEATING *for* MODERN AIR TRANSPORTS

By JACK McGUIRE



One of United Air Lines' $3 million fleet of 28 "Mainliners." Equipped with two double-bank 14-cylinder Wasp engines developing a total of 2300 hp., this 21-passenger type transport has a top speed of 212 m.p.h. and a cruising range of 1500 miles without refueling. Ten will accommodate 21 passengers, 10 will carry 14 passengers, and eight wi'l be 14-passenger sleeper type transports. These planes are being placed in service on the New York-Chicago-Pacific coast and border-to-border routes.

NEWS in the field of air travel is the announcement of millions of dollars spent for new 200-mile-an-hour airplanes whose comfort will keep pace with their speed, for passengers, by means of a new departure in plane heating and ventilating systems, will be able to enjoy 70F conditioned air throughout a 15-hour flight from winter's sub-zero temperatures in the east to the summer temperatures of California.

United Air Lines' new three million dollar fleet of 28 12-ton 1937 type twin engine Douglas DC-3 transports will incorporate the advantages of steam heating in a system capable of an output sufficient to heat a five-room house on the ground, and weighing only 140 lb., including the boiler and the 8 qt. of water necessary for its operation.

60 Changes per Hour in Summer

The spacious cabins of United's luxury 14-passenger planes, in which only 14 seats are placed in a 21-passenger cabin for maximum comfort, and 21-passenger type planes to be used on shorter flights will be ventilated by utilization of the plane's 3-mile-a-minute speed through the air to obtain change of cabin air without need for mechanical circulating devices taxing the weight allowances. A supply of freshly heated air, the temperature of which is thermostatically controlled with optional manual control, will be introduced to the cabin at a flow varying from a summer rate of 1200 c.f.m. for a complete change of the air in the cabin every minute to a winter flow of 400 c.f.m. in severe cold to provide a complete change of air every four minutes, with adequate preheating, more than is required for the same number of people in a closed compartment on the ground.

Air for cabin ventilation is admitted through a vent in the nose of the fuselage and transmitted to individual manually controlled ducts at each seat, in the pilots' compartment, lavatory, and galley. In order to insure uniform inside temperatures, however, the fresh air is preheated before entering the cabin by passing over the coils of a tubular radiator located under the floor in the forward end of the cabin. A portion of the incoming air may be bypassed directly to cool air outlets at each seat or to a mixing chamber in the warm air line to mingle with the heated air for further moderation of its temperature. Regulation of the proportions of heated and unheated air entering the mixing chamber for distribution to the individual heating ducts is made by levers located in the cabin and operated by the stewardess. An additional duct system, connecting directly with the intake valve operated by the pilot, delivers cool air to the second set of outlets which the passenger may open or shut at will.

Flash Type Boilers

Exhaust gases are employed to generate the steam for the system by means of a flash type tubular boiler set in the exhaust outlet of the right engine of the plane. At temperatures in the vicinity of 1700F the gases pass over a web of stainless steel tubing welded into headers in the walls of the exhaust line and extending forward and to the rear in concentric parabolas. Water

fed to the boiler from an 8-qt. reservoir in the forward baggage compartment of the plane is flashed into steam at these high temperatures and distributed to the radiator under the cabin flooring.

The return from the radiator communicates with the boiler through a drain manifold located in the lowest point of the steam line and draining by gravity to the boiler. Steam in the system is maintained at a pressure of 25 lb.

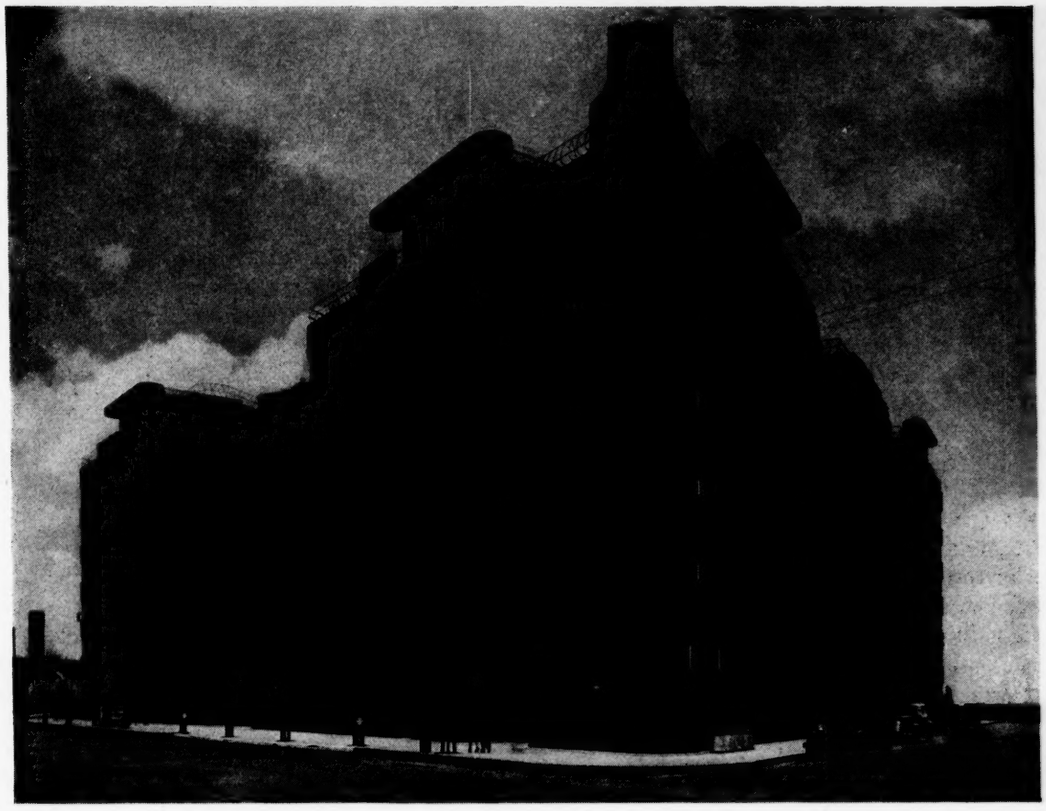
Supplementing the steam heating systems of the new planes, the air line will continue to operate mobile air conditioning units at principal airports for conditioning the air in the cabins of its planes prior to take-off, since the plane's system begins to function only after take-off. These units, fitted for heating the air during winter and refrigerating it during summer, bring the temperature of the cabin to 70F before passengers are boarded.

Engines Total 16,100 Hp.

Marking a high point in the development of passenger service in United's ten years of airline operation, during which it established the world's record of 100,000,000 passenger miles and more plane miles than any other airline in the world, the company's new fleet of steam-heated luxury airliners are the most powerful passenger land planes in the country. Powered by two 14-cylinder twin-row Wasp engines, each capable of a maximum output of 1150 hp., the new airplanes can cruise at 62½% power and still make the fastest speeds desired. Fully loaded, the two engines will climb the plane to 24,300 ft. and with only one engine in operation level flight at 10,500 ft. can be maintained. The transports can take off after a run of 980 ft.

Having a fuel capacity of 820 gal. of gasoline and 34 gal. of oil, the new planes will permit United to operate from California to New York with only two refueling stops and non-stop from Chicago to New York with sufficient extra fuel to turn around and almost fly back to Chicago.

Interior of new United flying club-car. Seating 14 passengers in a 21-passenger cabin, these planes will provide new luxury for cross-country travel by air. Each seat is full swivel and may be inclined 45° for resting. Passengers flying in 15 hr. from the east to California in the new planes may spend the time in 70F conditioned air. Several are already operating on commuter schedules between Los Angeles and San Francisco.



Brighton Beach Garden Apartments, overlooking New York Bay.

Simplicity is the Feature of Apartment Heating System

By JOSEPH F. KERN, Jr.†

A NEW development in heating systems and heating controls has been incorporated in the buildings of the Brighton Beach Garden Apartments, erected last year by Brighton Beach Garden Apartments, Inc., on a site overlooking lower New York Bay. The apartments are located at 1120 to 1170 Brighton Beach Avenue and are housed in two buildings, each building being in the shape of an unbalanced U with one leg longer than the other. In reality each of these buildings is a double building with each unit being entirely independent of the other except for a common lobby. This arrangement makes it possible to divide the apartments into four buildings in case they are ever offered for sale. There are six floors in each building with a total of approximately 1500 rooms divided in 314 apartments.

The two units of each building have entirely separate heating systems and are entirely independent of each other except for cross connections between the boiler plants. These cross connections are provided so that steam may be supplied in emergencies to both units of the building even though one boiler may be out of operation.

†Assistant Editor, HEATING & VENTILATING.

The steam for each unit is provided by an oil-fired steel boiler which burns No. 6 oil. The boiler serving the longer wing of the U has a rating of 22,650 sq. ft. e.d.r. while the one serving the shorter wing has 19,880 sq. ft. e.d.r.

Approximately 900 radiators are used in each of the two buildings with approximately 22,000 sq. ft. of radiator surface or a total of 1,800 radiators and 44,600 sq. ft. in the two buildings. The radiators are divided on a 4-5 ratio and the square feet of surface on a 10-12 ratio between the short and long ends of the U in each building.

The heating system is an extremely simple one, being merely a two-pipe vapor system with orifices in the intakes and having no traps or condensate pumps. Special inlet valves at each radiator contain adjustable orifices which are used to proportion the flow of steam in accordance with the capacity of the radiator.

When the system was first put into operation each orifice was adjusted so that it would not allow any more steam to enter the radiator than can be condensed. With this arrangement all steam would be condensed in the radiators and none would pass to the returns. For this reason no traps are provided on the radiator outlets. The condensate is returned by gravity through a wet

return to the boiler with a Hartford loop serving to prevent the water from backing out of the boiler. Air from the returns is carried by means of a dry return to a common point where an air eliminator is provided to vent the air. Four of these eliminators are used in each heating system. The pressure in the returns is maintained at all times at atmospheric pressure as these eliminators are opened to the air.

A hot water storage tank is provided in each boiler room with a storage capacity of 2500 gal. A temperature control in the hot water storage tanks keeps the temperature of the boiler water at 180F so that a plentiful supply of hot water is available at all times.

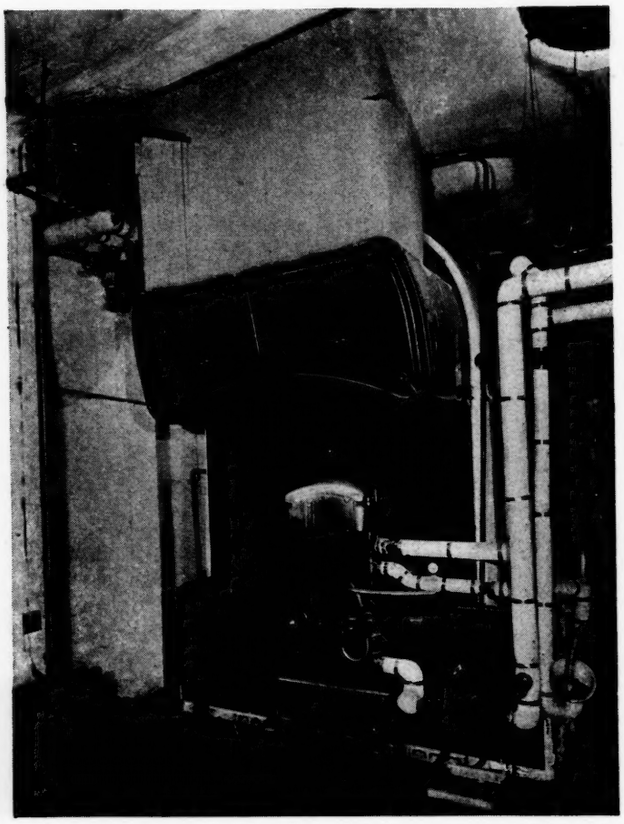
Oil storage tanks of 5000-gal. capacity are located in a separate room near the boiler room.

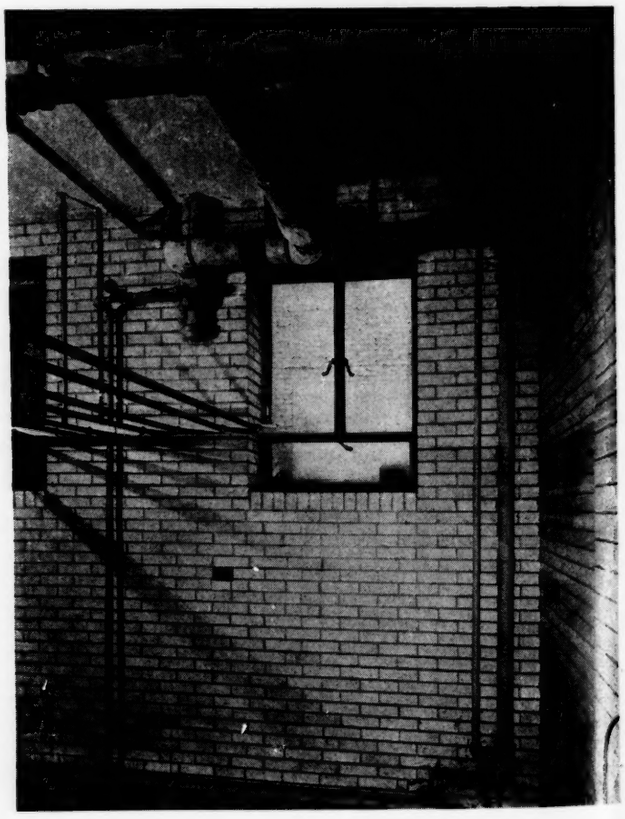
Operation of the Control System

Used in the system is a new type of control unit which has been under test and observation in the New York area prior to release for national sale. It proportions the flow of steam in accordance with both interior and exterior conditions. The operation of the system is based on the assumption that the temperature of the condensate is a measure of the heat input in the building. As the steam condenses in the radiator and the condensate runs down the radiator walls, the condensate will be cooled in proportion to the temperature of the radiator surface. Thus, when the radiator is full of steam, the condensate temperature will be close to the steam temperature since it has no chance to be cooled. On the other hand, when only a small amount of steam is in the radiator, the condensate will be greatly cooled and its temperature will approach the temperature of the room. The cooling which generally occurs in the return lines is usually constant and small in comparison with that in the radiator. If a temperature control is inserted in the condensate return and hooked up so that it controls the flow of steam to the building, it is possible to maintain a given condensate temperature, or in other words a given heat input to the building.

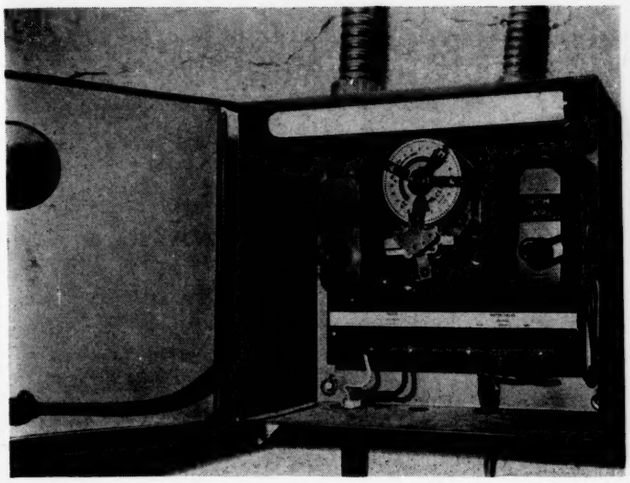
As the outside weather conditions change some means of changing the condensate temperature or heat input to the building must be provided. The method of doing this is as follows: A temperature sensitive element is placed on an outside wall of the building—a wall which is protected from the sun. Both this element and the one in the return are of the liquid expansion type. The tubes from the elements are connected and a common tube is run to an electrical switch which shuts off the oil burner when a given pressure is developed in the tube by the expansion of the temperature sensitive liquid. As long as the outside temperature remains constant, the temperature of the condensate is also kept constant. When the outside temperature falls, the pressure in the outside element decreases due to a contraction of the liquid and the condensate will have to reach a higher temperature before the liquid in the condensate element expands sufficiently to build up the required pressure to shut off the oil burner.

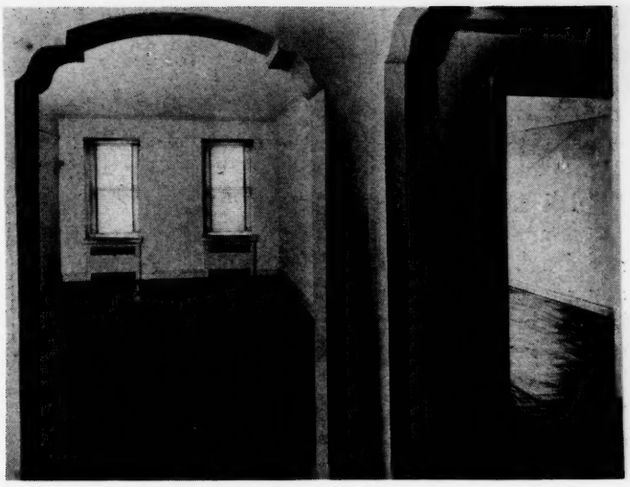
The reverse is also true. As the outside temperature increases, the liquid pressure in the outside element increases. The burner will then not operate until the con-





(Left) Oil-fired steel heating boiler which is used to heat one section of the apartments. Four of these boilers are used to heat the entire group. (Right) Steam supply and return main in one corner of the basement. Note the absence of the drip trap on the riser drip at upper left hand corner of picture. One of the air eliminators is shown in the upper right hand corner.





(Left) Interior of automatic control. At the right is the daytime control; at the center is the automatic time clock, and at the left is the heat-up control. (Right) A typical apartment in the Brighton Beach Garden Apartments. All heating surface is concealed.

densate temperature decreases sufficiently to lower the pressure in the control tubing to the required pressure. In other words, the outside element raises and lowers the condensate temperature (or the heat input into the building) in direct proportion to the outside conditions.

In order to shut off the heat during the night and to heat the building rapidly in the early morning hours two additional devices are employed. The first of these is a clock which shuts off the burner at a designated time during the night and starts it up again early in the morning. The second device takes care of the heating-up period. During the morning when there is a demand for large amounts of heat, the control of the system is shifted by the clock to a second electrical switch which is actuated by the same elements as the first but is so set as to maintain a higher condensate temperature for the same inside and outside conditions.

In the Brighton Beach Apartments, the clock is set so that the steam is turned on at 5 a.m. and the normal control operates the system until 6 a.m. At this time a clock shifts the control over to the heating-up control and this operates the system until 9 or 10 a.m. when the clock returns the system to the regular operation. All heat is shut off at midnight by the clock control.

A pressure limiting control is provided on the boiler to prevent the steam pressure from exceeding 1½ lb. At this pressure the amount of steam passing through the orifices will be just equal to the maximum amount which the radiators are capable of condensing. Any excess pressure would force some uncondensed steam into the returns.

When the heating control calls for heat the burner will start operating and continue until either the demand for heat is satisfied or a pressure of 1½ lb. is reached. If the limiting pressure is attained first the pressure control will stop the burner. If the control still calls for heat when the pressure falls below 1½ lb., the burner will start operating again.

If for any reason the pressure control failed to operate it would be impossible to waste much steam to the return since as soon as some steam does get into the return, the condensate temperature will increase and the condensate control will shut off the burner.

The general contractor of these buildings was Joseph P. Day and the heating contractor L. B. Berley Inc. American Radiator Company furnished the radiators, valves, air eliminators, and controls; Petroleum Heat & Power Company the oil burners, and the Kewanee Boiler Corporation the boilers.

Ingenious Application of Unit Coolers in a Hospital

TWO cooling problems in the nursery and the operating room at Baylor University Hospital, Texas, have been solved by the use of ingenuity and unit coolers.

The matter of nursery room temperature is a vital factor in keeping very young babies well. When room temperature rises above normal body temperature, these new-born babies acquire what might be termed "induced fever." Their body temperature will become the same as the high room temperature, even though there are no physical disorders in the infants.

The problem was complicated by the fact that there was no suitable location for a high side for use with the unit cooler. There was, however, a circulating cold water line at 45F available inside the nursery door.

A unit cooler was connected to this line and installed on a table stand in a corner of the nursery. Tests showed a 14-16F temperature drop, which is ample to bring the room temperature well below the danger point even on hot summer days.

Another interesting and effective use of a unit cooler was worked out for cooling operating rooms. A tank for ice water was mounted on a small truck along with a unit cooler. A small motor-driven circulating pump connected between the tank and unit cooler circulates the ice water through unit cooler and back over the ice.

Shortly before the operating room is to be used, the unit cooler and pump motors are plugged in and the room is brought down to a comfortable working temperature.—*Leo J. Freitas in "Fedders News."*

A Reference List of Important Publications Dealing with Heating and Air Conditioning

THE accompanying book list is the result of an attempt to answer a more or less idly put question asked us not so long ago. The question was somewhat along these lines: What books would probably be found in the library of an engineer concerned with all phases of heating and air conditioning; a library that could be considered fairly complete and yet not so encyclopedic as to be impracticable. The question is more or less timely, since the literature of the art has multiplied several times during the past decade.

In compiling the list it soon became apparent that by no means was all of the worthwhile literature on heating and air conditioning to be found in books. A very considerable part of it is in pamphlets, booklets, mimeographed sheets, and other publications put up in either temporary or semi-permanent form. Consequently, it was felt not only desirable but absolutely necessary that the list should include important publications of this character.

In the case of books—that is, permanently bound publications—these are usually either so well known or information about them can be found so readily that it was felt necessary only to give the author's name. In the case, however, of pamphlets and booklets and other semi-permanent publications as indicated by (P) in the list, in addition to the author's name, the name of the publisher or sponsor is given in order to assist the user to locate the publication. It is quite obvious that even with the additions so made the list is still not complete.

Four very important sources of material are: 1—business papers, especially those devoted primarily to heating, ventilating, and air conditioning; 2—the transactions of technical societies, especially those dealing largely with heating, ventilating and air conditioning; 3—publications, either wholly or partly of purely commercial character, published or sponsored by manufacturers or manufacturing organizations. Some of the most worthwhile data which have ever been used in the field of heating and ventilating have originated with the engineering staffs of manufacturers of equipment, and first published in these manufacturers' catalogs and handbooks; and 4—books, pamphlets, and other sources of information which are now out of print but some of which occupy such important places in the literature of art that they are still necessary in any complete library.

The reader who would be inclined to build up a complete library on the subject should, we believe, subscribe to one or more business papers in the field, follow closely the transactions of various technical societies, and keep in touch with manufacturers' catalogs and handbooks as they are issued from time to time.

No such list as this can ever be said to be complete. Any names which are omitted from this list have been left off for one of the following four reasons: 1—We did not know of the reference; 2—If we did know of it we did not have it in mind while compiling the list; 3—It was not felt to be an important enough publication to include in the list; or 4—Copies are known to be no longer available. At any rate we will welcome any criticism on the subject from readers who have additions that they believe should be made to this list.

REFERENCE LIST

Steam and Hot Water Heating

Steam Heating, *Dye.*

Hot Water and Steam Supply By Electricity, *Smith.*

The Design of Gravity Circulation Hot Water Heating Systems, *Giesecke.*

Water Supply in Buildings, *Mosely; Mumm Print Shop.* (P)

Warm Air Heating

Gravity Warm Air Heating—Digest of Research at the Engineering Experiment Station; *University of Illinois.*

Forced Air Heating Facts from the Research Residence at the University of Illinois, *Konzo.* (P)

Standard Code Regulating the Installation of Gravity, Warm Air Furnaces in Residences; *National Warm Air Heating & Air Conditioning Association.* (P)

District Heating

Handbook of the National District Heating Association.

Transactions of the National District Heating Association.

Economical Distribution of Steam in District Heating, *Abell.* (P)

Efficiency and Economy—Study of Underground Steam Distribution Systems, *Woolrich and Holdredge.* (P)

Heat Transfer

Heat Transmission, *McAdams.*

Evaporating, Condensing and Cooling Apparatus, *Hausbrand.*

Industrial Heat Transfer, *Shack; Translated from German by Goldschmidt and Partridge.*

An Investigation of Certain Methods for Testing Heating Insulators, *Grundhofer; The Pennsylvania State College.* (P)

Investigation of Heating Rooms with Direct Steam Radiators Equipped with Enclosures and Shields, *Willard, Kratz, Fahnestock, and Konzo; University of Illinois.* (P)

The Heat Output of Concealed Radiators at Various Temperatures, *Allcut; University of Toronto.* (P)

Further Tests on the Heat Output of Concealed Radiators, *Allcut; University of Toronto.* (P)

Effect of Enclosures on Direct Steam Radiator Performance, *Fahnestock; University of Illinois.* (P)

Heat Transmission Through Building Materials, *Rowley and Algren; University of Minnesota.* (P)

Heat Flow Meters for Thermal Conductivity Measurements, *Hechler and Queer; The Pennsylvania State College.* (P)

Heat Insulators, *Griffiths; Department of Scientific and Industrial Research Food Investigation, Special Report No. 35. (Great Britain).* (P)

Comparative Heat Loss Tests on Insulated and Uninsulated Building in the Electrified Mason City at Grand Coulee Dam Site, *Dana and Lyle; State College of Washington.* (P)

Engineering Data on Flow of Fluids in Pipe and Heat Transmission; *Crane Co.* (P)

Investigation of Various Factors Affecting the Heating of Rooms with Direct Steam Radiators, *Willard, Kratz, Fahnestock and Konzo; University of Illinois.* (P)

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Cost of Burning Heavy Fuel Oil

THE real measure of cost of fuel oil in oil burning equipment is the cost per B.t.u., not the cost per gallon. As engineers and architects, you are naturally interested in when to specify equipment for automatic use of the heavier oils, and why. The primary consideration, of course, is economy of operation and dependability. No. 2 oil, for which many automatic burners are available, sells for 6¼ cents per gallon of 138,500 B.t.u., or 4.5 cents per 100,000 B.t.u. No. 5 oil sells at 4.405 cents per gallon of 148,000 B.t.u., or 3 cents per 100,000 B.t.u., and No. 6 at 3.5 cents per gallon of 152,000 B.t.u., or 2 1/3 cents per 100,000.

As easily can be seen, No. 6 oil is much cheaper, and a proper question is—why not use No. 6 oil exclusively for all heating purposes? This is not the answer to economy in all cases. Automatic equipment burning heavy oil is *not* a cure-all for the high cost of heating. I am not trying to convince you that you should specify automatic heavy oil burning equipment whenever you can squeeze it in, but rather to tell from the cumulative experience of the burner industry when it should be properly specified or installed.

I do not believe No. 5 oil should be used in any plant which requires the burning of less than 8 or 10 gal. per hr., and I do not believe No. 6 oil should be used in any heating plant requiring less than 15 gal. per hr., or approximately 22,000 to 25,000 gal. per season. By that I do not mean that every heating plant with a load of 5000 sq. ft. of steam should be burning No. 6 oil. From a practical standpoint the cost of equipment and oil storage enters into the consideration, and from an engineering standpoint the combustion space, type of boiler, and draft conditions must be taken into consideration.

No. 2 oil can be purchased in lots of 100 gal. or more, with delivery as often as necessary. No. 5 oil is delivered in compartment or full tank lots, usually 1500 gal. at a time, so a 2000-gal. tank or larger, is required. No. 6 oil is delivered hot in full tank wagon loads through a 5-in. fill pipe and at least a 2500-gal. tank should be available, with manhole and ladder for cleaning the tank from time to time.

Automatic equipment and a 275-gal. tank for No. 2 oil can be bought for almost any price at about $200 up. Automatic equipment for No. 5 oil, with suitable storage tank, costs approximately $1300 for the smallest size. Automatic equipment for No. 6 oil, with suitable storage, costs approximately $1800 for the smallest practical size. Thus it can be seen, even if you saved 2¼ cents a gallon on 5000 gal. of oil per year or $337, the difference in capital investment would offset the saving. While installation of equipment for burning No. 5 oil fully automatic is no great problem if there is sufficient combustion space, draft, etc., the burning of No. 6 oil automatically is quite a different story.

Its most important characteristic is its viscosity. The effect of this causes more consideration than anything else in the production of suitable burners and accessories to prepare and burn the oil. Where viscosity has a uniform decrease with the rise of temperature, little difficulty is encountered. However, when viscosity diminished abruptly with the application of a small amount of heat, difficulty is encountered in designing proper compensating devices to insure constant flow of oil to the burners.

While viscosity of No. 6 is described as from 100 to 300 sec. at 122F, much No. 6 is delivered at considerably lower viscosity. I have found some as low as 23 sec. This variation of viscosity "does things" to the oil when it is heated, and the variation, with carbon residue, sulphur, sediment, and water are the problems which must be overcome by proper design and installation of and attention to automatic equipment burning No. 6 or Bunker C oil.—*Abstracted from an address by Glenn Arnold before a joint meeting of the Producers' Council, Boston Oil Burner Associates and the Air Conditioning Bureau of Boston.*

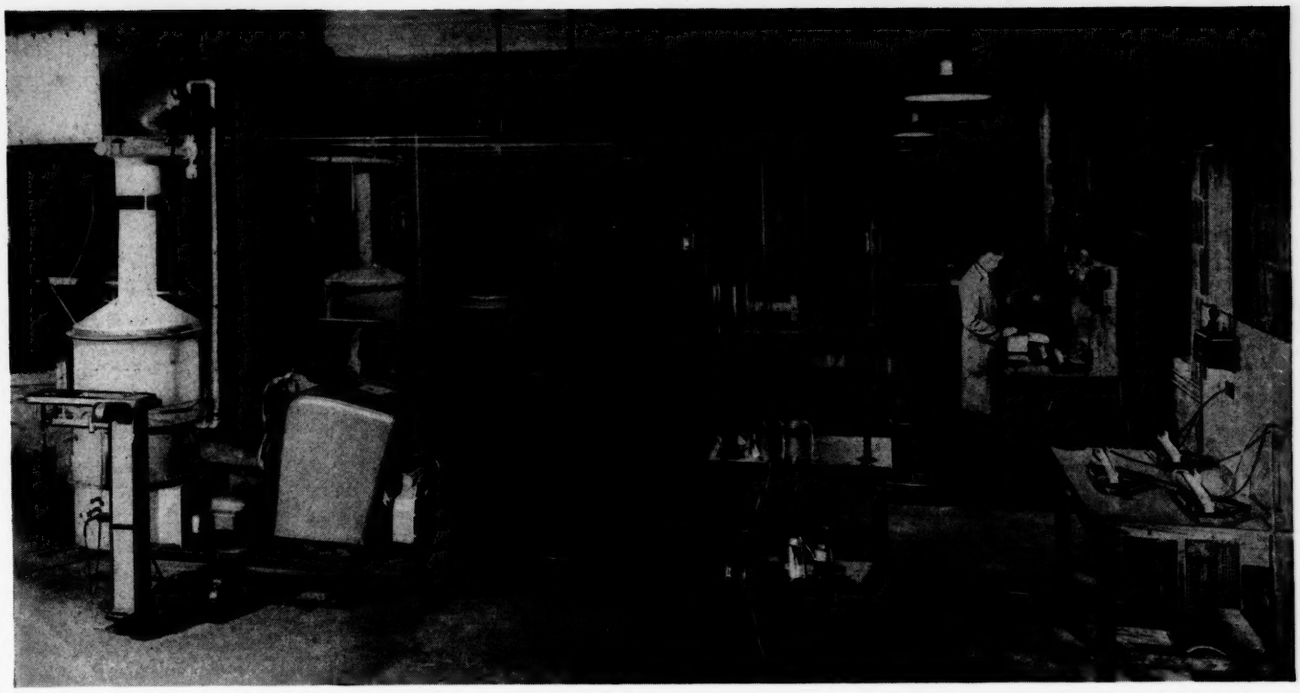

Fig. 1. Fuel laboratory of the Battelle Memorial Institute where the tests on the combustion of bituminous coal in underfeed stokers were conducted.

Combustion of Bituminous Coal in the Small Underfeed Stoker

By RALPH A. SHERMAN† and E. R. KAISER‡

THE remarkable increase in the distribution of the small underfeed stoker for use in furnaces and boilers in small industrial plants, apartment houses, and homes has brought producers and distributors of bituminous coal to consider the problem of which coals and which sizes are best suited to this market. Many papers have also appeared, mostly in the trade journals, discussing the problem of the combustion of various coals and various sizes of coal in small stokers. Much difference of opinion has been apparent in these articles, due often to a misunderstanding of the fundamentals of the process of combustion in the stoker fuel bed.

The purpose of this paper is to follow the coal from the hopper through the furnace with a discussion of the various actions that occur, in the hope that it will lead to a clearer understanding of the relation of the type of coal, the size of coal, and other characteristics, to the performance. The authors do not pretend to have obtained the answers to all the complex questions involved; many unanswered questions will be proposed on which future research work is planned.

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‡Assistant Fuel Engineer, Battelle Memorial Institute.

This article contains one of the best discussions on the combustion of bituminous coal in small underfeed stokers which has appeared to date. The information has been obtained from Technical Publication No. 750 published by the American Institute of Mining and Metallurgical Engineers, New York.

Flow of Coal from Hopper to Retort

The coal is fed, in these small stokers (30-35 lb. of coal per hr. maximum), from the hopper or bin into the retort by means of a feed screw. During this travel the coal is generally degraded in size to some extent, and in the hopper, in the feed tube and in the retort the various sizes tend to segregate even if an entirely uniform mixture of coal has been placed in the hopper. The fines tend to trickle through the coarse coal and be fed from the hopper first; they drop to the bottom of the feed tube and are pushed up toward the rear of the retort, usually at an angle to the axis of the screw on one side or the other, depending on the direction of rotation of the screw.

Investigations have shown that the segregation is decreased by bringing more closely together the limits of the sizes of coal fed to the stoker, preferably by a decrease in the top size, for the use of large sizes will result in crushing and the production of smaller sizes.

The segregation of coal sizes is generally accompanied by a greater rate of feed to the rear than to the front of the retort, partly because of the increased bulk density of the

coal containing the finer sizes and partly because of the natural tendency of the screw to push the coal up the inclined face of the retort. Uneven feeding to various parts of the retort is undesirable.

Effect of Heat on Coal

Figs. 2 and 3 have been prepared as a basis for the discussion of the effect of heat on the coal as it rises into the burning zone, and of the subsequent carbonization and combustion; Fig. 2 represents a fuel bed with a relatively free-burning coal, and Fig. 3 a fuel bed of a strongly caking coal. These figures are not idealized; they are diagrammatic sections of actual fuel beds obtained by observation during the course of burning tests and by careful disassembly of the beds at the close of the tests. They show the segregation of the coal in the feed tube and the retort with the fines at the bottom of the feed tube and back of the retort (left-hand side) and the coarse at the top of the feed tube and front side of the retort. The zone of plastic coal, the incandescent and black coke, the fine ash and the fused clinker, and the flames, are shown.

Because of the segregation of the sizes of coal and possibly uneven feeding, there will be some difference in the actions occurring at the front and rear of the retort. The actions with assumed uniformity of size and feeding will be discussed first and the effect of segregation will be taken up later.

As the coal rises in the retort toward the zone of combustion established by previous kindling of the fire, it is heated by conduction and radiation from the combustion zone. The coal rises in temperature and first gives off moisture and occluded gases, which are largely noncombustible. As it is further heated to 700F to 800F, the coal particles become soft, the edges round off, and finally they become plastic. The degree of plasticity

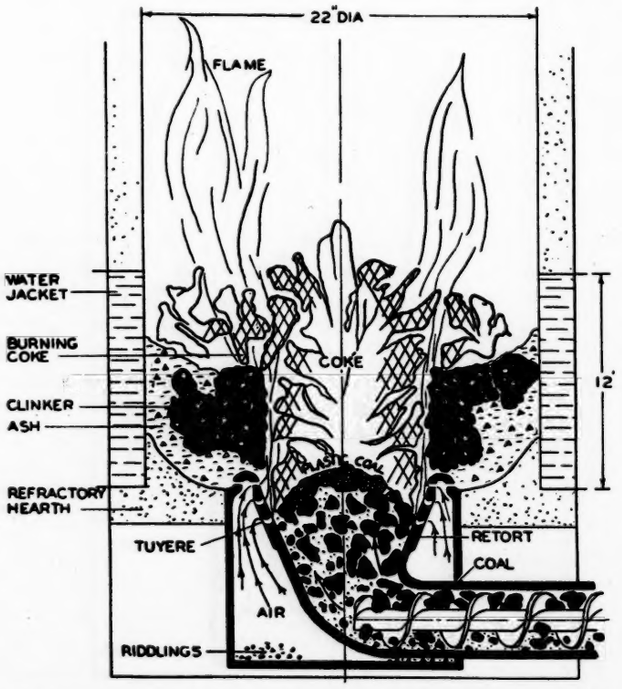


Fig. 2. Cross-section of retort and fuel bed with a weakly-caking coal. The coke tree was open and poorly cemented so that it extended only a short distance above the hearth.

is governed by the origin of the coal, by the petrography of the individual particles, by the rate of heating, and by the extent of exposure to air during heating.

Some coals become so plastic that they have the consistency of a frothy tar, whereas others soften only slightly. Therefore some coals so fuse together that the identities of the original particles are lost to the unaided eye, whereas others merely sinter together. The time during which the coal is plastic, and its degree of fluidity, determine the distance the material can flow under the pressure to which it is subjected. Therefore, for a given coal the sizes of coal particles and voids determine the degree of cementation of particles.

The plastic properties of coals have been investigated by a number of workers, among whom are Davis, Gieseler, and Laying and Hathorne. They find that the temperature range during which coal is plastic is only about 150F, after which the coke becomes hardened. Fig. 2 shows the plastic zone to start at about the level of the lower row of tuyeres in the stoker and to increase in thickness toward the center of the retort. It is thin near the tuyeres because of the oxidation by the air. It is thicker in the center because of the lesser penetration of air and the longer time for development of plasticity and cementation of particles. Fig. 3 shows that with the more strongly caking coal the plastic zone is somewhat higher in the retort and is considerably thicker than with the freely burning coal of Fig. 2.

At the rear of the retort, where there is a greater percentage of fine coal, the voids are smaller and the particles fuse together more readily into a strong coke. At the front, where the coal is larger and the voids larger, not only does the size of the voids hinder the formation of strong coke but the air can penetrate more freely and lessen the development of the full plasticity. As previously mentioned, the rate of coal feed to the front half of the retort is frequently less than that to the rear. For this reason, also, the resistance of the fuel bed is less and, consequently, the rate of air delivery is greater at the front than at the rear. Some manufacturers of stokers compensate for this tendency by a decrease in the area of the tuyeres in the front part of the retort.

Evolution of Gas from Coal.—During and immediately after the plastic stage of the coal, the rapid evolution of the combustible volatile matter takes place. As this is in the zone where, during the "on" periods, an ample supply of air is available from the tuyeres at high velocity, good mixing takes place, the mixture is ignited, and rapid and complete combustion occurs with little or no cracking of the hydrocarbons, which causes liberation of free carbon as soot.

Carbonization.—Above the plastic zone, the distillation of the volatile matter continues and the coal becomes coke. The coke will not be of the same nature as that formed in the coke oven because in the stoker fire the coke is not restrained from expansion and is exposed to oxidation. However, even high-oxygen coals, which usually are considered noncoking or free burning, form coke in the underfeed stoker. This is proof of the rapid rate of heating in the fuel bed, for it is only with rapid heating that such coals exhibit plasticity and coke formation. The cokes vary in strength and porosity

according to the characteristics and the sizes of the coals.

The coke mass continues to grow as more coal is pushed up from below and heat penetrates from the top and sides. The coke formation is variously called a coke "plug," "tree," "spire," or "spar." The difference in the type of formation with the two coals of different degrees of coking is shown in Figs. 2 and 3. The coke from the more strongly coking coal extended upward over 2 ft. and then broke off near the top. A number of cracks are visible where future fractures would occur. The coke trees always lean to one side, although conditions at the base or a force at the top may cause a shift in the inclination.

The coke from the more freely burning coal was open and poorly cemented, so that it extended only a short distance above the hearth. Pieces of coke fell from the tree at the slightest disturbance.

An increase in the air-coal ratio tends to decrease the size of the coke tree, especially the weight of coke on the hearth. Low heat release rates, particularly hold-fire operation when coal is fed only for a few minutes at intervals of 30 min. to an hour, tend to increase the coke tree formation.

Low volatile coals, such as Pocahontas No. 3, are strongly coking coals, although they are not used alone for cokemaking because of their swelling tendencies; they make coke trees, as would be expected. Pocahontas differs from high volatile, strongly coking coals, however, in that the coke more readily breaks apart.

Combustion of the Coke.—Figs. 2 and 3 have shown that in the center of the stoker retort there is a plastic zone surmounted by a column of coke, which are both quite impervious to air. Little opportunity exists, therefore, for combustion at the center of the retort. As previously mentioned, the first combustion is that of the combustible volatile gases evolved from the coal; then the air burns the coke around the base of the coke tree and the pieces of coke that break off from the tree and fall into the air stream. With the more freely burning coals, as shown in Fig. 2, the coke formation is loose enough so that the air penetrates into the upper part of the tree and combustion occurs over a wider area, but with the strong coke formations the upper part cools, becomes black, and burns only after it falls back into the air stream.

Are Coke Trees Undesirable?—Those who have fired coal by hand in small furnaces have been accustomed to attempt to maintain a uniform, level, incandescent fuel bed. Furthermore, many of the pictures in the advertising literature of small stokers show a uniform, nicely rounded fuel bed, with rather distinct zones for the various reactions. When the user opens the door of his furnace for the first time after installation of a stoker and sees a ragged fuel bed with a spar of coke emerging from the center of the retort and leaning over toward one wall, he feels that the stoker or the coal is not acting as it should. He is likely to reach for the poker, break up the coke, and level off the fuel bed.

Our experience, and that of others, indicates, however, that the undesirable features of coke-tree formations have been greatly exaggerated. Even with a strong degree of coking, if the combustion chamber is so designed that the coke when it breaks down by itself falls into the gas stream, where it can be burned, the coke formation does little harm.

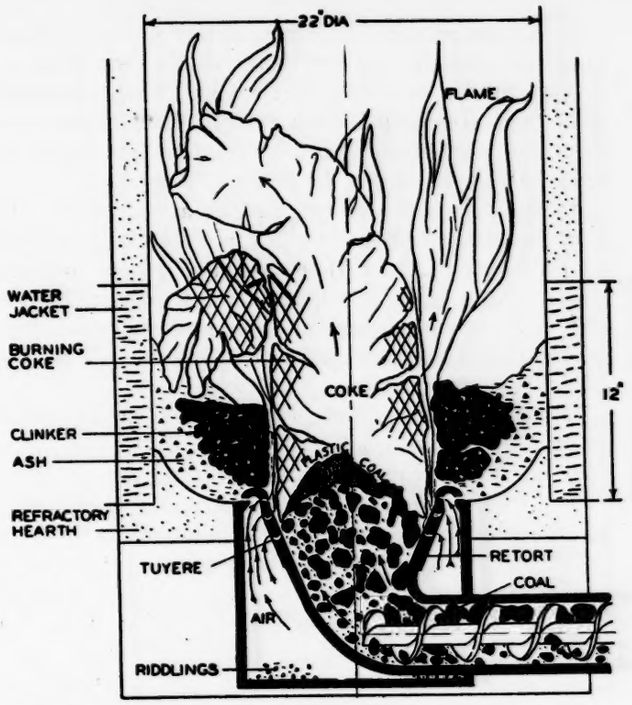


Fig. 3. Cross-section of a retort and fuel bed with a strongly-caking coal. The cake tree in this case extended upward over two feet.

A somewhat undesirable feature of such strongly coking coals is that so much more combustible material is in the furnace at any time that the removal of the clinker is more difficult than from the thinner fuel bed of a freely burning coal. Also, after removal of the clinker, the fuel bed is always broken up and compacted, so that for the first one or two operating periods thereafter the flue gases may contain a rather high percentage of carbon monoxide. In extreme cases, the plastic coal and coke may be so impenetrable and the coke so strong that only a weak ring of flame exists at the base of the coke column; then when the coke tree falls over it may carry the fire with it and the fire will go out. In other extreme cases of improper design of combustion chamber or improper installation of the stoker, the coke may fall out of the gas stream, so that it cannot be burned; it may even rise to stop the outlet of the combustion chamber, or it may push open the firing door.

No sharp line of demarcation exists in the caking and coking properties of coals, below which coals are suitable and above which they are unsuitable for present small stoker use. Furthermore, the coking properties of a coal in a stoker fuel bed may be modified, as was indicated in the discussion of the plastic state, by change in the size and the size distribution of the coal. The removal of fines from stoker coal is becoming increasingly common practice. The object of this practice is varied. With some coals, it may be to reduce the ash content, to render the coal less dusty, or to reduce the coke-tree formation.

Inasmuch as the removal of fines generally raises the problem of their economic disposal, and frequently results in a wastage of coal, the determination of when and to what extent it is desirable to remove the fines

is one of the principal problems of the present research program. Briefly, our experience at this time shows:

1. With the relatively free-burning coals, although coke trees are formed, they are not troublesome and, from the standpoint of coke formation, no particular advantage results from the removal of fines.

2. With strongly coking, semibituminous coals, the coke formation is not greatly affected by the removal of the fines, partly perhaps because of the inherent coking characteristics of the coals but largely because, as a result of their friability, a large percentage of fines is found in the retort, although none is in the coal in the stoker hopper.

3. With high volatile coals that coke enough to cause some of the difficulties described, the adjustment of the size range will generally reduce or eliminate the difficulties. The aim is so to increase the size and percentage of voids in the coal in the retort as to decrease the strength of the coke. Therefore, the adjustment of the size range will normally be affected by the removal of fines, but it may also require a reduction in the top size. If the top size is too great, the crushing may produce too much fines in the retort. Whether the removal of fines should be at 48 or 10 mesh, at ¼ or ⅜ in., cannot be answered generally for all coals. Each coal is yet more or less an individual problem.

Smoke

As previously discussed, the volatile matter of the coal is liberated as the coal passes through the plastic stage and is formed into coke. As this occurs at the level of the tuyeres where the combustion air enters the fuel bed, the gas and air are thoroughly mixed and the hydrocarbons are burned without cracking into carbon. During "on" periods of stoker operation, therefore, no smoke is produced unless the air-coal ratio is reduced to near the theoretically required value.

When the heat requirements have been met and the stoker shuts off, distillation of gases from the plastic coal and semi-coke continues but little air is now entering the tuyeres, the hydrocarbons are cracked as they pass over the hot coke, and smoke is produced. Records have been made of the concentration of smoke produced as it is affected by the air-coal ratio, by the size of the coal, and by the type of coal. The data show that the smoke decreases as the air-coal ratio increases, but that the size of the coal is a much smaller factor in determination of the amount of smoke than the type of coal. For coals in the same content of volatile matter, the concentration of smoke appears to be greater with the coal of greater caking tendencies.

The amount of smoke in the "off" periods can be decreased by increase of the excess air in the "on" periods. An increase in excess air will decrease the efficiency of heat transfer in the boiler or furnace. Therefore the attainable efficiency for a given allowable smoke concentration will be less for a coal with greater smoking tendencies.

Judged by the familiar standards of the appearance of the stack, the smoke density from the laboratory test furnace with the smokiest coal that we have yet tested exceeds No. 3 Ringelmann for short intervals only. This degree is mentioned because many municipal smoke ordinances limit the production of smoke to six minutes of No. 3 smoke in an hour. From a domestic furnace or boiler, the smoke would generally be less because of the leakage of air through cracks and slots in the firing door; this leakage would probably only dilute the smoke and not actually burn it.

Ash and Clinker

The individual pieces of coal entering the stoker retort have various petrographic structures. Some consist largely of coalified wood and contain only 1 or 2% of finely divided and well dispersed inorganic matter. Others contain higher percentages of ash-forming materials such as sand, clay, shale, and stone, depending upon the seam, care in mining, or degree of cleaning. Each piece of coal loses its combustible and volatile constituents in the fire, leaving only the inorganic structure in modified form.

Some ash fuses into beads at the surface of the coke as it is released but most of it is freed from the coke in unfused flakes or grains. A part of the ash may be carried out of the furnace with the gases but by far the largest part remains on the hearth.

Starting with a clean hearth, whether or not a refractory fillet has been provided, as shown in the laboratory test furnaces, the first ash tends to fall and remain at the place of least turbulence, which is at the corner of the wall and the hearth. The ash layer thickens with time and it seeks its angle of repose sloping upward from the retort to the wall. The ash near the retort is exposed to widely fluctuating temperatures which at times are high enough to fuse the ash or some parts of it so that it forms a ring of clinker concentric with the retort. Thus the loose ash is converted into a few compact and dustless pieces, which can be conveniently removed daily, or at longer intervals, with the clinker tongs provided with the stoker.

The degree of fusion depends on the temperature attained in the fuel bed, the chemical composition and homogeneity of the ash, and the time of heating. Coals of which the ashes have high fusion temperatures may cause difficulty during mild weather when the temperature is not high enough to fuse them. A wide range of ash-fusion temperatures has not yet been covered in the laboratory tests, but it is known that coals with ash-softening temperatures from 2,000F to 2,700F have been used successfully.

The clinker is generally weakly sintered at the bottom and lies upon a layer of loose ash. It builds up vertically and outward radially as more ash accumulates. The inner face is nearly a vertical wall, somewhat irregular but generally well fused, which forms a retaining wall for the ash and an annular channel through which the combustion products pass.

Because the degree of fusion of the ash into clinker is a function of time as well as temperature, the suitability of a coal for small stoker use, from the standpoint of the type of clinker formed, cannot be judged by a short-time burning test. This is particularly true if the area of the hearth of the furnace is large with respect to that of the stoker retort. Time must be allowed for the ash to accumulate between the furnace walls and the retort to bring it to the zone where the temperature is in the range of the ash fusion.

Overall Stoker Operation

The rate of coal feed on small stokers is generally variable; on most stokers it is variable by three to five steps, as 10, 20, or 30 lb. per hr., and on some it is continuously variable over a range of three or five to one. The specified rates of feed are only nominal, as at any given setting the rate may vary by as much as 25%, dependent on the bulk density that is affected by the size and distribution of sizes of the coal, on the top size of the coal, and, to some extent, on the friability.

The rate of air supply likewise is variable, generally continuously, over a wide range by means of a damper at the inlet of the fan or in the air duct between the fan and the stoker windbox. The fans used are multiblade centrifugal fans, which have the general characteristic of decrease of delivery with increase of the static pressure against which they operate. Many stokers now incorporate some method of automatic control to offset the natural tendency of the fan output to decrease with increase in static pressure. Generally, the aim is to maintain the delivery constant regardless of the static pressure; within, of course, the limits of the cut off pressure of the fan.

Nicholls has shown that at low rates of air supply the rate of burning is fixed by the rate of air supply, and at high rates of air supply the rate of burning is limited by the rate of ignition. However, these rates are beyond the rates at which the small stoker is designed to function, and with any given rate of coal feed, and over a wide range of rates of air supply, the rate of burning will equal the rate of coal feed. This is obviously necessary if uniform, continuous operation is to be maintained.

Let us assume a stoker fuel bed in which the rates of coal feed and air supply and the thickness of fuel bed are at some constant equilibrium values. If the rate of coal feed is maintained the same but the rate of air supply is increased, the rate of burning is increased for a short time because each pound of air will continue momentarily to burn the same weight of fuel; because more air is supplied, more fuel will be burned. Therefore, the amount of fuel in the stoker fuel bed will decrease; that is, the bed will become thinner, which will cause the amount of fuel burned by each pound of air to decrease until the rate of burning is again just equal to the rate of fuel feed. The composition of the flue gases will have changed and the depth of the fuel bed will have decreased, but the rate of burning will again have become constant at the previous rate.

Similarly, if the rate of air supply is maintained constant and the rate of feed is increased, the rate of feed will temporarily be greater than the rate of burning, until the fuel bed has increased in thickness to the point at which the weight of fuel burned by each pound of air is great enough to bring the rate of burning into equilibrium with the rate of feeding.

This discussion shows that the thickness of the fuel fed, or rather the amount of fuel in the bed, at any time is a function of the rate of feed, the rate of air supply, the type of coal and the size of coal. The fuel bed thickness is not an independent variable that can be controlled without change in the other factors. The familiar statement that one should carry a thicker or thinner fuel bed should be that one should decrease or increase the rate of air supply.

If a coal is noncaking and noncoking, so that a porous fuel bed is formed through which the air can penetrate freely, each pound of air will unite with its quota of combustible in a short distance and a relatively thin fuel bed will result. If the coal is caking and coking, of the type shown in Fig. 3, where combustion can occur only on the outside of the column of coke and on the relatively large pieces of coke broken off the coke column, a longer distance of travel is necessary for the air to unite with the combustible and a deeper fuel bed will result for the same air-coal ratio.

This discussion has inferred continuous operation of the stoker but the same principles apply for intermittent operation. The rate of air supply to the stoker during the "off" periods is at a low rate, on the order of 10% of that during the "on" periods, but as the coal feed is stopped and the "off" period may be prolonged the fuel bed may burn down appreciably. At the beginning of the next "on" period, the rate of burning will be less than the rate of feeding, and the fuel bed will gradually increase in thickness again.

This analysis of the relation of the rate of feeding, the rate of air supply, and the depth of the fuel bed has shown that conditions tend to remain in equilibrium when air is supplied at a constant rate. The value of an automatic air control is easily seen, therefore. Without automatic air control, if a hole develops in the fuel bed from any cause, the resistance of the fuel bed is decreased and the rate of air supply from the fan increases. This tends to aggravate the hole and make conditions worse. Likewise, if the fuel-bed resistance increases, the air is decreased, the rate of burning decreases, the fuel bed becomes thicker and the condition is again further aggravated.

When a hole develops in a fuel bed of a stoker equipped with a properly functioning air control device, the air remains constant. Because of the hole, the CO_2 decreases, which means that the rate of burning decreases, but as the rate of feed is constant, the rate of feed will be greater than the rate of burning and the hole will be automatically corrected. Similarly, an increase in fuel-bed resistance will be automatically corrected.

For short "off" and "on" periods of the order of 10 min. each, the CO_2 content of the flue gases will generally be higher in the "off" than in the "on" period by 1 or 2%, and some unburned combustible gases, carbon monoxide, hydrogen, and methane are frequently found. These result from the continued evolution of the volatile matter after the stoker shuts off; the small amount of air that enters by natural draft does not become well mixed with the combustible gases. During the "on" periods, the amount of unburned gases is negligible unless the air-coal ratio reaches small values, corresponding to 15% CO_2 or more.

The rate of burning is so low in the "off" period that the loss of heat in unburned combustibles, based on the entire amount of fuel burned, is very low. Because of the difference in the gas composition and the difference in the rate of burning, the gas should always be sampled and analyzed separately for the "on" and "off" periods.

ENGINEERING NOTEBOOK

Instantaneous Analysis of Air for CO_2 and H_2O Now Possible

An instrument that measures instantaneously carbon dioxide concentration in air with a precision of one part in a million, was described recently at a plant physiology symposium of the American Association for the Advancement of Science at Atlantic City by Dr. E. D. McAllister, Smithsonian Institution physicist.

The instrument is based on the fact that carbon dioxide is nearly opaque to a certain narrow band of radiation in the invisible infrared spectrum. A beam of this "light" is shot through a quantity of air which one desires to analyze. It fails to get through to a degree corresponding to the number of carbon dioxide molecules that are encountered. That which does get through falls upon a spectrograph which is so arranged as to admit only radiation of this particular wave length. Behind the spectrograph is a thermocouple, a delicate radiation-measuring device.

The radiation falling upon the thermocouple sets up minute electric currents, in proportion to its intensity, which are recorded on a galvanometer. It is so sensitive that as little as one part of carbon dioxide per million of air can be detected. The same precision could be reached by microchemical analysis, but it would require half an hour or more, and progressing changes, of the utmost importance, could not be detected.

By use of another infrared wave band it measures just as accurately water vapor content of the air. It constitutes perhaps the quickest and most accurate means of chemical analysis known for a limited field of gas mixtures.

A possible future field of usefulness will be in measuring human basal metabolism, now a standardized medical practice which requires a long time. With this instrument, there is every reason to believe, the measurements could be made cheaply and in a few minutes.

Dust Control Preventive Engineering

It may be said that, in general, the engineering specialist can and will devise the necessary equipment to meet the conditions specified to him. But the setting of limits of permissible dust concentration is not his but the physician's responsibility. The engineer is concerned with keeping dustiness to or below the limits at present considered satisfactory.

Some dusts (as lead) are determined by chemical methods and the concentrations in air are recorded gravimetrically as milligrams per cubic meter. Others (as silica, where size is a factor in determining dangerous particles) are given by count. Neither method gives the whole story, but in both cases it may be possible to secure the information necessary.

There are various figures that have been given and are being used as guides to permissible dustiness where free silica is present. It should be noted that many of the data were not determined as the medical requirement, but as being attainable in good practice and apparently satisfactory from a safety standpoint.

In South Africa the figure is 1 milligram per cubic meter (or 300 particles per cubic centimeter, or approximately 8.5 million per cubic foot).

Doctor Lanza found in 1917 in the Joplin, Mo., district that, with good engineering practice, a figure of 1 milligram per 100 liters of air could be attained.

The U. S. Public Health Service, in its study in the anthracite region of Pennsylvania, found that 50 million particles per cubic foot with 5% quartz in the coarse dust and 10 million particles per cubic foot with 35% quartz were apparently satisfactory.

The figure of 10-20 million particles per cubic foot for granite dust with 35% quartz content is often quoted from the Vermont granite studies of the U. S. Public Health Service.—*Abstracted from a talk by H. B. Meller, Managing Director of Air Hygiene Foundation, at National Safety Congress, Atlantic City.*

Operating Procedure Cuts Air Conditioning Power Costs and Reduces Cold Shock

The engineers of the Brown Shoe Company in St. Louis have developed a method of operating their office building air conditioning system during the summer to permit the office workers to become tempered to warm outside conditions before leaving the building in the afternoon. At about 4 o'clock in the afternoon, the refrigerating plant is shut down and the temperature is allowed to rise gradually until 5 o'clock when the employes leave the office without any sensation of shock due to higher outdoor temperatures. This practice has the additional advantage of reducing power consumption of the refrigerating plant.

Heating "Peeves" of Homeowners

A recent survey of the customers of the Niagara Hudson System, operating public utilities in upstate New York, to which 11,207 replies were received, reflected the desires of homeowners regarding heating. Of the list of pet "peeves" of those replying, 5355 gave third place in a list of 20 peeves to "can't heat rooms evenly." This peeve was led only by "not enough closet space" and "not enough electric outlets." Fifty per cent of those replying reported that they must have thermostatic control and 47% reported that they would like thermostatic control.

Operating Facts on Air Conditioning

Electric Utility Committee Publishes Its Annual Report

FOR the past several years a committee of Edison Electric Institute organized as the Air Conditioning Sub-committee of the Sales Committee has published very helpful reports. Under the chairmanship of C. E. Michel, of the Union Electric Light and Power Co., St. Louis, Mo., the report of the activities of this committee for 1936 has recently appeared in print.†

A greater part of the Bulletin is taken up by factual data gathered from all parts of the country and giving data on nearly 200 installations in all kinds of buildings. Many of the installations listed were included in a previous report of the committee a year ago and are repeated because two years' operating records are now available.

It is especially notable that in many localities there seems to be no definite relation between the dry bulb temperature recorded and the number of hours during which the summer air conditioning equipment operated. The present committee, however, notes that there is still basis for the belief that eventually a relationship between outside temperature and hours of operation may be shown.

Presentation of so many facts regarding the operation of summer air conditioning plants is especially notable because very little of such information has heretofore been in existence. There is enough of variety in the kinds of installations reported and also in their location geographically to make it possible to get some idea of what operating figures are like for a plant of almost any size in almost any part of the country.

Virtually no published information has been in existence regarding the number of hours per season during which summer air conditioning plants operate. The appearance of these operating facts tends to bear out more strongly than ever the extent of the variation which can be expected in such figures. In the city of St. Louis, for instance, factual information is given on about 10 installations. The "hours use of refrigeration" is not given in all cases but in one general office the hours' use is given as 1720 in 1934, while in a general office building, this same item is given as 1253 hr. in 1934 and 1302 hr. in 1935. Residence figures are grouped together for St. Louis and it is interesting to note that for a dining room and bedroom the annual operating hours was reported as 1355 for 1934 and 333 in 1935. It is also interesting to note that this figure of 1355 is by far the maximum figure reported for any residence in St. Louis and also the 333 is the smallest number reported for any residence. In general, the number of operating hours reported for St. Louis is around 850 in 1934 and is very considerably smaller in 1935. The report does not include any explanation as to the wide variation in the figures or as to the reason for the very sharp difference between the hours of use in 1934 and in 1935.

In spite of inconsistencies in interpreting the factual information given, it is by far the best which has ever appeared and its lack of consistency is undoubtedly due to difficulties of measuring and other factors brought about by the attempts at collecting data being early ones. The factual data section contains a wealth of information for everyone interested in checking through to see how summer installations really do operate.

Another subject which is given attention in the report is that of attic ventilation and the circulation of air in residences. A number of the electric utility companies have been advocating the use of circulated air in residences. Various examples of local advertisements carried on by electric companies to promote this kind of summer cooling are included in the report. The report does not attempt to list or catalog the various kinds of equipment used for this purpose but does give a discussion of some of the methods in use. The following quotation taken directly from the report shows the types of equipment and the various names applied to these methods of cooling by the committee.

"In addition to the older type of equipment used in attic ventilation up to last year, there has recently been evolved what is designated as the 'multiple fan' type of installation. This combines a peculiar flexibility and ease of installation with other advantages which appear to give it much promise.

"Advantages, of course, are claimed for both types, however, the fact remains that the new system represents quite an advance in the art. In some locations —notably homes where roofs are extremely low-lying or flat, no other designs but the 'multiple type' attic ventilation equipment can well be made use of.

"In New Orleans during the summer of 1935, thirty of these new type installations were successfully made, and the committee is informed that similar assemblies were made in various other cities throughout the country. Control of operation of the various fans forming the ventilating unit is effected ordinarily through three circuits with conveniently located switches allowing, in the case of a six-fan unit, the turning on of one fan pulling as it does about 1,700 c.f.m. By actuating the next switch we turn on two more fans, and then if needed the third switch starts up the remaining bank of three fans, giving in all about 10,000 c.f.m. and a unit control when combined with the self-closing doors that would seem to meet, for a small or medium size home, any desired gradation of ventilation, with night time incidental cooling effect of considerable value.

"By simply adding or subtracting from this 'package unit' procedure almost any desired condition can be taken care of, thus simplifying and, so it is claimed, cheapening costs and allowing the dealer to carry in stock only one size fan.

†Report carries publication No. D12 and the title, "Air Conditioning 1936." Copies available from Edison Electric Institute, 420 Lexington Ave., New York, at $3 to non-members in U.S.A., $3.15 foreign.

"Top Floor" Roof Ventilation

"Many apartments on top floors become unbearably warm during summer months with resulting vacancies, and often sizeable losses to owners. Attic exhaust or 'roof type,' using no matter what variety of ventilation fans, when properly installed, will convert these suites into the most comfortable rooms in the building.

"The following plan, as now being made use of in the city of Chicago, is predicated on the recognition of the hot summer condition which exists on the top floors of most flat-roof apartment buildings. Third floor rentals in many areas, so it is said, are at least five dollars per month lower than lower floor rentals because of summer heat.

"The treatment of the top apartment would be as follows:

1. Several outlets would be cut through the ceiling into the plenum chamber between the ceiling and roof.
2. These outlets would be covered with insulated damper-type grilles.
3. A roof-type ventilator would be located on the roof at a central point with respect to the grille locations.

"The plan of sale would be put on an investment basis and the building owners or managers would be approached. Some such economic analysis could be prepared:

Ten-year increase in revenue at $5 per month		$600
First cost of installation	$200	
Carrying charges at 6%	$120	$320
Net profit on investment		$280

"Such a sale plan has numerous advantages over the single family attic ventilation sale. Some of these are:

1. Larger sales potential since a single building may have six to eighteen top floor apartments.
2. Sales to large real estate management firms which control many buildings greatly reduces the cost of sales.
3. The roof ventilating system can be sold on a profitable investment basis rather than a pure cost-comfort basis as in the case of the single-family residence.

Window Ventilation

"The introduction during recent years of much new equipment has made possible the cooling and ventilating of apartments and one floor small homes by utilization of natural forces in a new and novel way. By placing these or similar makes of specially designed fans of large capacity in or near windows—so located as to exhaust heated air from the apartment and draw cool air of the night from distant locations through the room or apartment (preferably over the beds of the sleepers) there may thus be brought about immensely improved living conditions.

"Through the Transom" Ventilation and Cooling

"To take care of certain conditions inherent to apartment houses and hotels with noisy halls, or where it is objectionable on account of light sources, these fans in transoms have been ingeniously equipped with self opening and closing, and even 'self locking' doors, actuated automatically when the fan is started or stopped.

"Cool air of the night especially when in motion and drawn over the sleeper's bed, is a most delightful substitute for the hot, stuffy indoor air we ordinarily experience during summer time, and where complete air conditioning is barred on account of cost or other considerations, we have a low-priced substitute for the future cultivation of a great mass market. Service of this kind has been proved to have tremendous possibilities, and while only a step in the direction of real 'comfort cooling,' it can be had for about one-seventh the cost of air conditioning comparable areas."

In another section of the report the subject of residential air conditioning is briefly discussed. The conclusion reached by the committee members who drew up this section of the report is so interesting that it is reprinted here in full.

"At the present time, it is difficult to state accurately along what line the development of cooling and dehumidifying equipment for complete year-round residential air conditioning will proceed. Probably fan equipment will be operated almost continuously during the daytime hours of summer, so that the revenue to be derived from fan operation will be equivalent to that now expected during the winter operating period. Undoubtedly, the manufacturers of air conditioning equipment and the utilities will find it necessary to do considerable work in devising electrical motor equipment with characteristics to permit the handling of relatively large loads on the circuits in residential districts without serious disturbance to lighting.

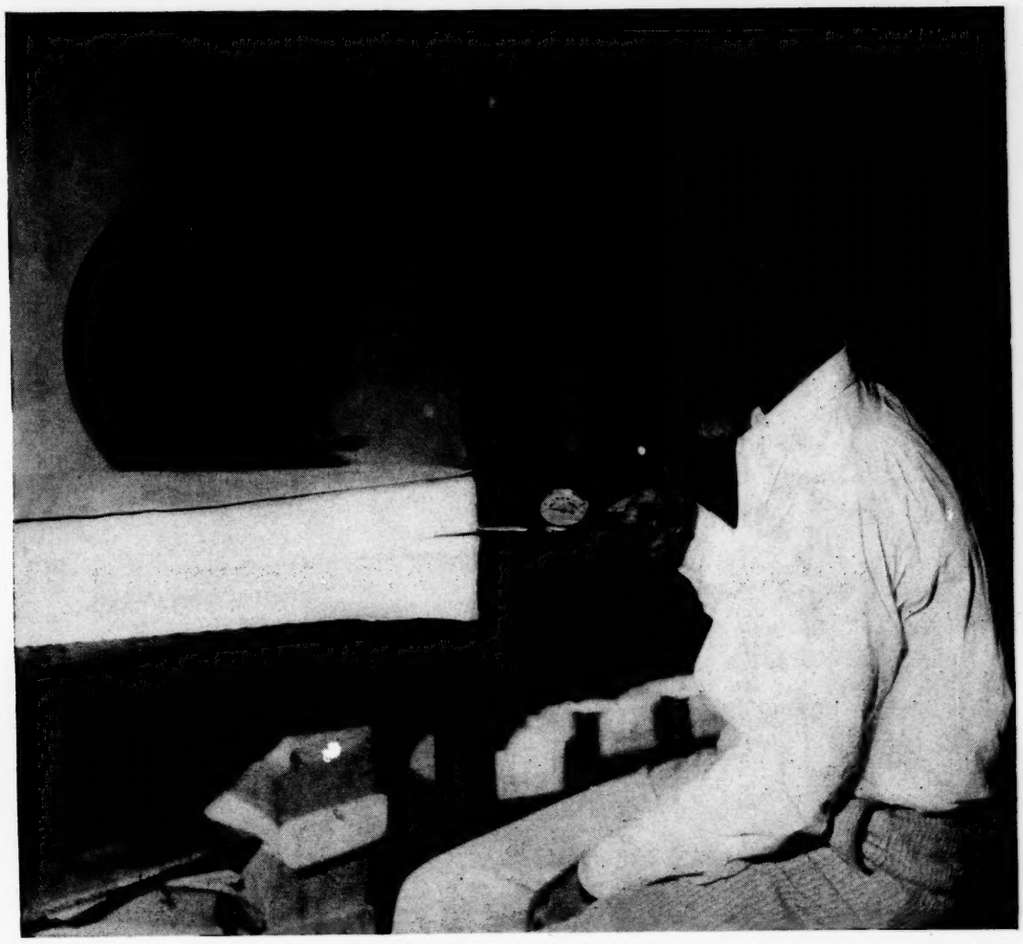
"Means must be provided to prevent the frequent cycling of the larger motors on residential air conditioning systems. When considered on the present basis of estimate, residential air conditioning loads have a low use factor. In order that first costs and operating costs may be maintained at a minimum, and so that residential air conditioning load will be attractive from the standpoint of the utility company, it will be essential that developments be made which will result in the use of low powered equipment over long periods of time to produce the same results now being obtained with high capacity equipment used for short periods.

"At the present time, using the accepted instantaneous basis for calculating heat gains for summer cooling, an excess of equipment is necessary to care for calculated peak periods over and above the capacity that would be required to handle the average load. Further investigation and experimentations will undoubtedly provide a basis of estimate which will permit utilization of the normal heat capacity of residences to maintain the desired temperature over peak periods. Some progress has already been made in this direction.

"Methods of refrigeration storage will be further considered, and it is possible that some practical means will be devised to permit the storage of refrigeration work done during non-peak periods for use during peak periods. If development along these lines is successful, it may be possible that residential installations in Baltimore, for example, will be cared for by equipment with a demand of 2 kw. or less operating 1500 hr. per summer season, rather than equipment with a demand of 5 kw. operating from 500 to 600 hr."

Air Conditioning in Industry

Part 3—Paper Making, Printing, Lithographing, and Plastic Manufacture



Using the sword type of hygrometer for determining the hygrometric condition of paper relative to the surrounding air.

By MARY O. SOROKA†

WOOD is one of the substances frequently put into condition to facilitate manufacturing by the use of air drying, or air conditioning as it might perhaps better be designated. Drying wood to 8% moisture is stated to be desirable for glue joint work and general finish; for high grade furniture and piano work, 6%. For shipping dry, from 25% to 30% moisture is retained in wood lumber. It is said that even well seasoned, air dried lumber piled under cover for years may still retain from 15 to 20% moisture content which often must be extracted from it by kiln drying before the lumber becomes suitable for manufacturing operations. Maintaining the right humidity in a lumber drying kiln throughout the drying period is important as otherwise too dry air may cause surface cracking and checking, while too moist air may bring about mildewing or staining.

†Engineer, Julien P. Friez & Sons, Inc., subsidiary Bendix Aviation Corp., Baltimore, Md.

Paper Industry

Closely allied to the wood industry are those industries which are concerned with paper. Paper is cellulose made from wood, cotton, or linen and humidity makes paper stretch, shrink, wave, or curl. It is a felted mass of minute vegetable fibers and is hygroscopic by virtue of its capillary structure. The physical strength of paper depends upon its moisture content to a great extent and other properties such as stiffness, smoothness, and finish of surface are all affected by the amount of moisture present. Since paper absorbs moisture from air the fibers swell, causing the paper to increase in area, while as it gives up moisture the paper shrinks.

In making paper, air conditioning is used in the testing of different grades, not only for its physical properties but for the evaluation of the pulps and the control of processes for preparing stock. For the last two purposes, hand-formed sheets of paper are made

under very exacting conditions and the physical properties of these sheets are measured in carefully regulated conditioned air. Great care is taken to insure that there is no variation of humidity, for a change might conceal or multiply the effects which are to be measured. This is of especial importance when controversies arise or when comparative tests must be made at separated localities or on different days at the same place. The practice of purchasing paper by specification makes air conditioning of much importance.

Air conditioning not only controls the temperature, humidity, and air motion, but filters and cleans the air. A most objectionable feature of paper is the unsatisfactory general appearance of a printed page due to dust on the paper stock. The presence of even minute particles of dirt, scarcely discernible to the eye, destroys the effectiveness of good printing and is particularly detrimental to highlight effects. The extent of this deficiency in the character of paper employed for good quality of printing is shown in the annual report of the Public Printer for 1934, showing 96 rejections on account of unsatisfactory general appearance out of a total of 310. This is 31% of the total number of rejections made during that year.

Printing

Intimately associated with the difficulties of paper manufacturing due to varying atmospheric conditions are the troubles of the printing industry. A change of 30% in relative humidity makes a 38-in. sheet of coated paper vary 1/6 in. A month's variation in the same pressroom has been observed from 6% relative humidity to 90% relative humidity. Troubles begin with a pile of paper waiting to be used. The edges only are in contact with the air and the moisture. As the edges absorb moisture they swell and wave; as they discharge moisture they shrink and curl. This makes the paper hard to feed into the presses.

Another problem is created by the friction of the paper going through the press which creates static electricity. Static is the cause of sheets sticking to each other and is the result of a hot dry atmosphere. In the language of the printing room, it is responsible for sheet feed hang-ups, smutting, failure of joggers to function and clogging of folders. As a safeguard against static, the majority of the presses and folders are equipped with electrical neutralizers which dissipate electric charges as they accumulate upon paper. Low humidities not only produce static, curling paper, and wavy edges but also result in paper breaks on web presses, and the cracking of coated paper in the folders. Pressroom humidification should be kept constant at 60 to 65%. Binding and folding rooms are considered suitable when kept at 35 to 50%.

Humidifying alone will not solve all pressroom problems. Humidifiers only increase the moisture content of the air when it is excessively low, yet something must also be done when the moisture content is excessively high. The solution is controlled air conditioning.

Humidity also affects the manner in which paper "takes" the ink. Ink is taken in two ways—by absorption and by oxidation. On plain, dull, uncoated paper, ink dries by absorption, while on coated paper it dries by oxidation from the top down. If inks designed for drying by absorption are applied to a sheet which contains too much moisture, the ink does not set as quickly as it should, so that smearing is increased.

Rollers, made of gelatinous material, increase in diameter as much as ¼ in. when humidities are too high. They even melt down over the type forms. During periods of low humidity the rollers shrink, so that ink impressions may be light and blurred.

Register of color is one of the most difficult processes of printing when relative humidities are fluctuating. If three colors of a four-color job are printed and the humidity changes by as little as 5%, a 25 x 38 in. sheet can stretch as much as 3/32 in. in twenty minutes. It takes hours of a pressman's time to register the fourth color on the pages at the far end of the sheet.

Improper storage conditions are a serious handicap in printing. Although paper manufacturers encase paper of a definite moisture content in waterproof paper, when opened in the average print shop the paper will wave and curl. No standard for relative humidity has been adopted by paper makers of printers. Similar conditions are required for paper storage rooms at the mill and at the printing plant. Suitable conditions for paper storage are said to be obtained with a dry bulb temperature from 60 to 80F and when the relative humidity is kept from 35 to 50%.

In printing automatic accounting machine cards the requirements are very exacting. Expansion or contraction of the paper causes changes in the specified size of the cards resulting in improper register in the tabulating machines. Sometimes when the edges of cards are broken by wear and are exposed to atmosphere of high humidity they become swollen to a thickness sufficient to cause clogging in the throat of the machine in which they are used.

Air conditioning also improves plate making and offset printing. Plate making is one of the most important operations in lithographic printing. A glue solution is used in this process and if the humidity in the plate-making room is too high, the glue solution becomes too soft, making it difficult to produce the plates properly. The humidity should be kept constant at 50%.

In printing by the offset process (lithographing), water is used in order to keep the plate from getting too dry. If the plate dries too rapidly, more water must be added by means of what are technically known as fountains. On a dry day the fountains must be well opened so that plates receive the required amount of water. With relative humidity under control it is possible to keep fountains set at a certain point to produce uniform results instead of having the pressman worry about change of conditions every few hours or overnight.

It has been found that temperature control is also beneficial because the workers are more comfortable when not perspiring so freely and the paper can be handled more easily and without soiling.

Another reason for maintaining a controlled atmosphere where paper products are stored is in connection with record preservation. Many records are made on paper containing chemical pulp, only a few documents being of pure rag papers. Paper, if properly stored,

may last for hundreds of years, but it may be ruined in a month by bad atmospheric conditions. Moisture is less a governing factor in paper storage than the presence of acid fumes which rapidly destroy the paper itself. Libraries, record rooms, and art galleries situated near sources of sulphur-laden gases should be supplied with properly washed and conditioned air.

Dust Elimination

The problem of dust must be eliminated not only in printing but in the manufacture of plastic moldings. In the installation of a new press for forming large plastic moldings, an electrical manufacturer took special precautions to filter the air. If a single bit of dust got into the compound during loading it might possibly spoil the entire molding and provision was made to prevent the circulation of any dust or dirt in the air.

The system provides an abundant supply of clean, filtered air free from all traces of dust and in sufficient quantities to carry off the waste heat from the press. The velocity of the air is reduced in the room sufficiently to eliminate turbulent air currents which might scatter the powdered molding compound. A similar arrangement is provided to insure a dust-free atmosphere in the compound storage room. A maximum of one air change per minute can be secured in the press-room if desired. The plastic used was a urea formaldehyde which forms unusually light and durable articles when molded under high pressure.

Many other industries which also depend upon air conditioning have not been included because of the limitations of space. Some of these are: the ceramic industry which needs controlled conditions for drying; the steel industry which must protect plates in storage from rusting on days of high humidity; the automobile industry with the problems of bloom on painting done on moist days. The problems of the manufacture of tire fabrics, wooden spokes, etc., are phases of the industries already described in these articles. Air conditioning is used in the drying and processing of hides, skins, and the manufacture of leather bags, shoes, and findings.

This is the third of a series of articles by the author dealing with the importance of air conditioning in connection with the various industrial processes and their general industrial use. The fourth will appear in the next issue.

Effects of Heat and Humidity on Dairy Cows

THAT changes in temperature between 38F and 100F are much more potent in their effects upon the physical well being of Jersey cows and upon the amount and characteristics of the milk produced than changes in relative humidity between 20 and 90% are the conclusions drawn from the experiments completed recently at the research station and farm of the University of California. The tests were conducted over a period of 45 days in a large psychrometric chamber in which any desired temperature and condition of humidity can be maintained under switch control.

In confirmation of the practical experience of dairymen during the hot weather of summer, the milk production of the cows declined as the chamber was heated to high temperatures in simulation of actual conditions on the farm during the hottest months of the year. The reduction in milk yield due to the high temperature was as much as 30% in five days; a somewhat similar rise in the body temperature of the cows was also noted by observers.

In another test at the same research laboratory, Jersey cows which produced from 23 to 35 lb. of milk apiece daily were held in a respiration chamber at low temperatures (34F to 48F), at medium temperatures (63F to 68F) and at high temperatures (81F to 90F). The cows were milked twice daily and were fed to capacity with alfalfa hay, beet pulp, and grain.

The appetites of the cows decreased at high temperatures and this resulted in a corresponding decrease in milk yield. However, no perceptible influence of temperature on digestibility was discovered. The rate of respiratory exchange was higher at the low than at the medium temperatures; it increased with the increase of temperature to 80F. The total efficiency of energy utilization was higher at medium than at low temperatures and was consistently decreased at the high temperatures.

A third California experiment indicates that in certain sections where relatively high summer temperatures obtain for extended periods fresh green pasture as a sort of high temperature counterbalance may play an important role in keeping livestock comfortable during unusually hot, humid weather. When a high producing dairy cow is kept for more than 48 hr. at an environmental temperature above 85F in slow moving air, certain definite changes occur; the cow's body temperature will rise, her yield of milk declines, and the composition of the milk is altered.

Although the general impression prevails that dairy cows are rather sensitive to cold and must be housed in warm stables, actually milch cows are approximately as cold-hardy as sheep if they have access to a dry open shed which is free from drafts. The North Dakota Agricultural College in studying weather effects on livestock has run a small herd of cows outdoors day and night during the dead of winter and in subzero temperatures. The cows were driven into a stable for milking and feeding but ran in a lot with access to an open end shed. These cows withstood the exposure very well, the only casualty being one animal that suffered several frostnipped teats. However, the comfort and convenience of the dairyman and sanitary milk requirements justify modern stables for milch cows.—*Gene Day in "Taylor-Rochester."*

500 Attend 43rd Meeting of ASHVE

FIVE hundred and six members of the American Society of Heating and Ventilating Engineers registered by the third day of the Society's 43rd annual meeting, held in St. Louis, January 25-27. Severe floods in the midwest failed to dampen the enthusiasm of those attending the meeting, which was marked by a fine technical program and encouraging financial reports. Installation of new officers was held the closing day, the 1937 officers being: president, D. S. Boyden; first vice-president, E. H. Gurney, unable to be present due to a business trip to South Africa; second vice-president, J. F. McIntire, Detroit; treasurer, A. J. Offner, New York, re-elected.

Notable on the program were the papers on medical aspects of air conditioning, papers dealing with noise in connection with ventilation and air conditioning, and addresses at the annual banquet by Dr. A. C Willard, past president of the ASHVE and president of the University of Illinois; past president G. L. Larson, University of Wisconsin, and Bennett H. Chapple, American Rolling Mills Co. Talks by the last two speakers were broadcast over the NBC Blue Network.

The thermal properties of concrete construction have been under investigation for the past two years as a cooperative research program among the Society, the Portland Cement Association, and the University of Minnesota. The results of the first part of the work were reported in a paper entitled Thermal Properties of Concrete Construction, presented at the annual meeting a year ago.

Since that time the work has been extended to include more masonry walls, insulated monolithic walls, and the thermal conductivity of different aggregates. The second paper on this subject was presented at the St. Louis meeting by Prof. F. B. Rowley, Prof. A. B. Algren, and Robert Lander, all of the University of Minnesota. This paper covered the work completed since the previous report together with a summary and conclusions for the project as a whole, and deals with a more thorough investigation of different aggregates, both by the hot plate and hot box test methods, additional work on the insulating value of air spaces, and a rather extensive investigation to determine the value of different types of insulating materials when built as integral parts of monolithic concrete walls.

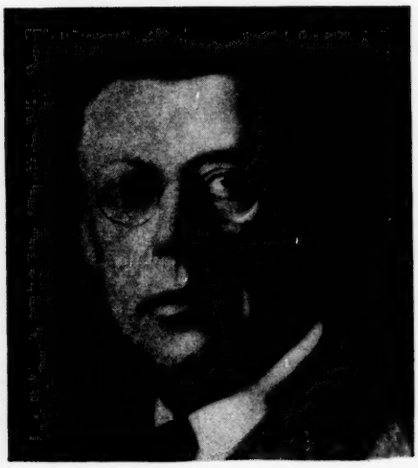
Several interesting comparisons may be drawn from the final test results for the masonry walls. One wall constructed of 5 in. x 8 in. x 12 in. 2-core sand and gravel tile was first tested with surfaces as laid, and next with outside surface covered with two coats of waterproof white cement paint. The overall heat transmission coefficients were 0.541 and 0.525, respectively, showing a reduction of approximately 3% due to coating the outside surface with paint. In the previous series of tests, 8 in. x 8 in. x 16 in. 3-oval core block walls were tested under similar conditions and showed percentages of reduction in the overall coefficients of 9.5, 8.3, and 3.5, respectively, for cinder, Haydite, and sand and gravel block walls. The results for the sand and gravel block walls check in the two series of tests and the percentage reduction is greater for the more porous aggregates, indicating that it is caused largely by a reduction in surface infiltration losses.

Two walls were built by using the 8 in. x 8 in. x 16 in. Haydite block wall, previously tested as a foundation and adding cinder furring tile for one wall and Haydite furring tile for another. Test results for these walls show an overall conductivity coefficient of 0.270 for the former and 0.281 for the latter or a reduction of 24% and 21% for the two walls, respectively.

Four tests were made on an 8-in. cinder block wall, without insulation, and then with granulated cork, dry cinders, and rockwool in the cores for the respective tests. For each other type of construction two tests were run, one without insulation and the other with granulated cork in the core spaces. The conductivity coefficients were corrected to a 15-mile wind velocity over the outside surface. The percentage improvement in the blocks is as follows:

TESTS ON 8 x 8 x 16 in. 3-OVAL CORE CINDER BLOCK

	% IMPROVEMENT
Air space in core, outside painted	—
Granulated cork in air space	45.7
Dry cinders in air space	23.5
Rockwool in air space	43.0



Davis S. Boyden, newly-elected president of the American Society of Heating & Ventilating Engineers.

Fan Selection

The fundamental variables involved in the performance of a given type of fan are quantity, head, efficiency, size, and speed. In all problems of fan selection the quantity and head are fixed by a definite external system requirement and the size and speed of the most suitable type are to be determined. The usual quantity-head characteristics showing the variation of quantity, head and efficiency for a given type of fan when the size and speed are fixed, do not lend themselves to the direct solution of problems of this kind, according to a paper entitled "The Specific Characteristics of Fans," by Prof. M. C. Stuart and J. B. Lusk, both of Lehigh University. The paper was presented by Prof. G. L. Tuve, Case School of Applied Science.

The authors' purpose was to present a new system of fan characteristics, based upon well-known fan laws which lend themselves to a direct solution of fan selection problems, serve to classify fans as to performance rather than form or design, and are directly useful in the solution of a great variety of fan application problems. These characteristics, termed *specific characteristics* by the authors, are an outgrowth of the specific speed functions which have been applied to hydraulic turbines, centrifugal fans and centrifugal pumps.

The basic feature of the specific characteristics of fans, or of other centrifugal machinery such as pumps, hydraulic turbines, and propellers, is that they show, for a given type of machine, the variation of size, speed, and efficiency when the external system of the machine is fixed. In the case of fans, the specification or fixing of external system fixes the quantity and head of the fan. For fans, then, the specific characteristic would show the variation of size, speed, and efficiency for a given type of fan when the quantity and head are fixed.

Included in the discussion was that of Prof. J. R. Weskey, of Case, who praised the ideas embodied in the paper and indicated that the paper should aid in advancing precise theory on centrifugal fans. Prof. R. L. Perry, University of California, suggested that total head, rather than static head, should be the basis of such a method.

Duct Design

Prof. L. G. Miller, Michigan State College, outlined "A Rational Method of Duct Design," especially designed for students and young engineers, but applicable to more complex problems also. Method employed is a combination of the *Velocity Method* and the *Friction Pressure Loss Method*. The

only velocities arbitrarily assigned are those where high values would lead to noise, or turbulence, or duct vibration. The remainder of the system is designed for equal overall friction drop without attempting to adhere to any specific pressure loss per foot of length. It is purposely left somewhat flexible in order to use, wherever possible, stock commercial sizes of duct and fittings and to permit other freedom of design. The ultimate aim is to be able to so design the system that it will reduce the amount of artificial friction, viz. dampers, splitters, etc., to a minimum if not entirely to zero. It is believed that the cost of power consumed by such artificial resistance will in most cases more than offset the cost of investment in more ample duct sizes. This is the *reasoning* involved in the method proposed.

"The Noise Characteristics of Air Supply Outlets" was the subject of a paper by D. J. Stewart and G. F. Drake of Barber-Colman Co. The paper summarized the results of studies of the noise level of grilles of various types and sizes and with different air velocities. The data were presented in a form that can be used conveniently in a straightforward method of grille selection which was described.

The tests reported by the authors were on a horizontal-finned type of grille. Derivation of formulas, together with graphs, were presented for use by the designer in solving for the quantity of air flow possible with a given grille of this type, knowing the loudness level acceptable, face velocity at the grille and constants depending on the grille under consideration.

Noise in Ventilating Systems

A progress report of study on the subject of noise control, entitled "The Nature of Noise in Ventilating Systems and Methods for Its Elimination," was presented by J. S. Parkinson, Johns-Manville. In the author's absence his paper was read by J. R. Patterson, also of Johns-Manville.

The author prepared and included a table of typical noise levels as encountered in various room locations, together with certain temporarily recommended practice regarding use of the data. His paper stressed the fact that annoyance due to sound regardless of noise level increases with the frequency of pitch.

The noise encountered in ventilating systems has three general sources, the motor, the fan, and the air itself. The motor generates frequencies which are related to the rotational speed, and the electrical frequency. The fan may generate sounds which are a function of its rotational frequency, and will also generate frequencies which are multiples of the blade frequency. The air moving past roughnesses or obstructions in the duct is set into vortices which give off high frequency sound. There may also be noise generated at the outlet which results from the abrupt change in dimensions or from faulty grille design.

There are a number of methods of preventing noise in ventilating systems, most of which are familiar. Vibrations can be prevented from telephoning through the walls of a duct by using suitable flexible connections between the fan and the duct. The fan and motor should be separated from the building structure by vibration insulating mounting. Fan speeds should be kept as low as possible, and equipment should be well balanced and free from excessive vibration. Large duct sections should be braced to avoid resonance and diaphragmatic response. Construction should be such as to avoid unnecessary air turbulence. All these are precautions which any competent engineer will observe.

But there are many cases where even with all precautions the system is still unsatisfactory. In such cases sound absorbent lining placed inside the duct can be used with good effect. In choosing such a lining, a number of factors must be considered. The most obvious is sound absorbing efficiency, especially in the range below 500 cycles. Nearly all acoustical materials display high efficiency at the upper frequencies, but special design is necessary to obtain efficiency in the low frequency range. If a porous material is used, it must possess a fairly high flow resistance.

In addition to a good absorption-frequency characteristic, the material must be resistant to moisture and vermin, non-combustible, and must offer little frictional resistance to the passage of air across its surface.

Body Temperatures with Controlled Environment

The director of physics and biophysical research at the Mayo Clinic and the Mayo Foundation, Dr. Charles Sheard, together with his associate, Dr. M. M. D. Williams, were the authors of a paper on "Investigations on the Exchange of Energy Between the Body and Its Environment."

The temperature of the skin in any small area is the resultant of the heat brought to it largely by the blood and of the heat lost by the various dissipative processes which have been mentioned. Hence the amount of heat to be lost, in order to maintain constancy of the internal temperature of the body, and the temperature and humidity of the environment into which this energy has to be dissipated are the two chief factors which control the temperatures of various parts of the surface of the body. Recent investigations have indicated that, under increased environmental temperatures or with an increased production of heat, there is a change in the amount of blood, under the control of the mechanisms regulating temperature, which is brought to various portions of the surface of the body. Apparently, within the comfortable ranges of temperatures and humidities, this accuracy of regulation, in order that the production of heat may equal the loss of heat, is accomplished largely by the peripheral vascular systems of the extremities.

The authors gave the results of investigations concerning the changes in temperature of the skin in various regions of the body produced under varied but controlled environmental conditions, direct evidence concerning the portions of the surface of the body which are chiefly concerned with the exchanges of energy between the body and its environment, as well as furnishing indirect evidence concerning the increase or decrease of supply of blood to various peripheral regions.

The authors showed that, generally, with normal subjects, body temperatures remain fairly constant under changing environment, excepting the temperatures of the extremities, notably the feet, and to a lesser extent, the hands. The temperatures of the feet and hands varied automatically to adjust for changes in the temperature of the air, for relative humidity, and for food ingestion.

Fever Therapy

In introducing F. C. Houghten, director of the Research Laboratory, Walter Fleisher stated that Mr. Houghten needed no introduction but did need greater appreciation for his work. Mr. Houghten presented a paper, "Fever Therapy Induced by Conditioned Air," of which he and his assistant, Carl Gutberlet, together with Dr. M. B. Ferderber of St. Francis Hospital, Pittsburgh, were the authors. They described the results of tests carried out in St. Francis Hospital using an air conditioned fever therapy box for the treatment of syphilis and gonorrhea. High-temperature air (105-110F) is supplied to the box which surrounds the patient's body but not his head. Seventy patients have been treated.

Gonorrhea, one of the most common of venereal diseases, has been treated in almost all of its phases. The organism Neisseria gonorrhoeae has a thermal death point between 106 and 107F in vitro, but workers previously have shown that if the patient's temperature is elevated between these points, the organism is destroyed similarly. In addition to this, elevating the temperature stimulates the body in such a way that the white blood corpuscles are increased in number. These act as scavengers, which clean up debris and inflammatory material left by the infection caused by the organism. This is especally true in females with gonorrhea, who complain very bitterly of severe pain in the lower abdomen. Because of the peculiar structure of the female pelvis and the location of the organs, there are many areas which become filled with this inflammatory material, binding down the organs in such a way that pain always occurs.

It is very gratifying to see these patients get relief even after one treatment of about one to three hours, and with a full course of treatment their pain recedes and does not recur unless they become re-infected.

In the male, the relief of urethral symptoms such as pain, burning, etc., is rapid with fever therapy. The use of this type of treatment prevents complications which leave their stigmata in the male. However, in both sexes arthritis caused by gonorrhea can be treated with fever therapy *specifically*. If treated early, there is no joint disability, and the patient is restored to usefulness. In chronic cases where some joint destruction has occurred, fever therapy frequently aids in restoring some function to the involved joint. When the excruciating pain of these arthritics and the striking relief obtained with fever therapy are observed, it is difficult to be skeptical about its usefulness. As in any other acute disease, the sooner treatment is instituted the more gratifying are the results. Experience indicates that 12 to 25 hours are required to clean up this infection with sessions of 3 to 5 hours' duration given at 3 to 7 day intervals.

In syphilis the situation is entirely different. The organism Treponema pallidum attacks certain organs of the body; namely, the circulatory system (heart, blood vessels) and the central nervous system. In the latter connection, the brain is so attacked that various degrees of insanity and other cerebral manifestations result.

Fever therapy arrests this degenerative process in a great majority of cases and frequently restores its victim to usefulness. Since the thermal death point of the organism varies from 103 to 106F, it has been the practice in this study to maintain the patient's temperature at about 105 to 106F. Malarial inoculation to produce fever has been in use for years. It is felt as a result of this study that artificial fever has the additional advantage of being safer to handle without imposing one disease on another. It is hoped further study will show the relative ease of artificial fever administration as compared to malarial inoculation in cases of syphilis.

The air conditioning is accomplished by a hot water spray, connected to the hot water supply system of the building, and spraying downward in an air tube. The velocity of the falling water induces air circulation in the tube, drawing air from the box and forcing it, after heating, back to the box, no fan being used.

The high temperature water spray serves to elevate the temperature and moisture content of the air. The slight drop in air temperature from the point where it leaves the water spray to the box insures saturation in the box at all times when the spray is running. The water spray gives sufficient air velocity in the 6-in. duct to produce a 115 c.f.m. air supply, or 2½ air changes in the box every minute. The high temperature humid air supplied at the top, and rapidly removed at the bottom, gives a very uniform air temperature throughout any horizontal cross-section of the box, and a temperature gradient from top to bottom of no more than 2F. The fact that neither a heater nor any other object or surface is ever found in the box at a higher temperature than the circulating air insures against burns from any imaginable accident or carelessness in operation. Since saturated air even at a considerably higher temperature than that used will cause no damage or disturbance other than an increase in the rate of rise in body temperature, there need be no fear of harmful effects from this source. Essentially, the air conditioning equipment is extremely simple and of the dewpoint control type.

Air Conditioning Standards

At the joint meeting of the ASRE and ASHVE last summer a committee of ten was appointed to formulate national standards for air conditioning. L. A. Harding was appointed chairman of this committee, which has held three meetings since last summer. Mr. Harding, due to illness, was unable to attend the convention in St. Louis, and his progress report of the committee's work was read by past-president John Howatt. Mr. Howatt said that at each meeting of the committee changes and revisions of the standards had been made, so that the standards are not complete and the work must be carried further, although progress has been made.

Cooling Requirements

Mr. Houghten presented the much-discussed paper on "Cooling Requirements for Summer Comfort Air Conditioning," by Mr. Houghten, F. E. Giesecke, College Station, Texas, and Cyril Tasker, Toronto. This paper, which included the results of studies in Pittsburgh, Texas, and Toronto, is one reporting studies which are part of a long series of similar investigations. The work was planned to give data on the following:

Desirable atmospheric conditions as regards temperature and humidity in still air for comfort in summer air conditioning, together with any variation in these requirements for different geographical regions having different weather conditions.

Allowable variations in the relative humidity of the air with optimum conditions of effective temperature, and any variation in the time required for the disappearance of sensible perspiration with variations in the moisture content of the air.

Variation in the required effective temperature for comfort depending upon the age, sex, and general health conditions of the persons involved.

The effect of the amount of clothing worn, particularly the effect of coats worn by men, on the desired effective temperature.

The effect of air velocities, above those usually used in air conditioning, on the cooling requirements.

The characteristics and seriousness of the cold shock felt upon entering a cooled space in the summer, together with the duration of the shock and the subsequent physiological reactions or sensations up to the time when complete comfort is established.

The physiological reactions and sensations of a person leaving a cooled space and re-entering the hot outside, and the duration of these reactions.

The study confirms the findings of a year ago that comfort may be had over a small effective temperature range, which is independent of daily or even weekly variations in outside weather. The results show clearly that with the weather conditions of last July in Toronto, an effective temperature of from 2 to 3F lower was required for comfort than was the case in Pittsburgh. Similar studies made in Texas prove rather conclusively that for its hotter, more continuous and longer summer heat, the same effective temperature is required as was found for Pittsburgh. In Toronto, 70% of the subjects were found to be comfortable over a range of effective temperatures from 68.5 to 71F; in Pittsburgh from 69.5 to 74F, and in Texas from 71 to 74F.

In order to minimize the cold shock upon entering a conditioned space, as well as to economize in the cost of cooling, an optimum effective temperature for air conditioning purposes is recommended near the upper limits of the comfort zone, or 71F effective temperature for Toronto, and 73F for localities having summer conditions as hot or hotter than Pittsburgh.

An intensive study of the relation of comfort to relative humidity with constant effective temperature indicates little or no measurable variation in the time required for perspiration to disappear and for comfort to be established in a relative humidity range from 20 to 90%. However, a recommendation for the use of relative humidities of 80% or higher must be given with reservation, due to the difficulty experienced in properly supplying these higher humidities in the summer with the air conditioning system available.

Sixty-one men, ranging from 20 to 65 years in age, were found to be comfortable over approximately the same temperature range as the trained, young subjects. A slightly higher temperature was indicated as desirable by men over 40. Few data were obtained for women of different age groups.

Clothing was found to have a material effect on the desired temperature for comfort. The wearing of a lightweight coat apparently decreases the temperature required for comfort by from 2 to 3F. Hence, the removing of such a coat raises the maximum temperature for comfort by 2 or 3F.

HEAT ADDED TO STILL AIR AT 70° BY HOT PIPES COVERED WITH PIPE INSULATION OF THICKNESS COMMONLY USED

Nominal Pipe Diam. (Inches)	Temperature of Hot Substance (Usually Steam or Hot Water) in Pipe															
	100°		120°		150°		180°		210°		240°		270°		300°	
	85% Magnesia	4-Ply Corr. Asb.	85% Magnesia	4-Ply Corr. Asb.	85% Magnesia	4-Ply Corr. Asb.	85% Magnesia	4-Ply Corr. Asb.	85% Magnesia	4-Ply Corr. Asb.	85% Magnesia	4-Ply Corr. Asb.	85% Magnesia	4-Ply Corr. Asb.	85% Magnesia	4-Ply Corr. Asb.
½	4.9	5.8	8.2	9.8	13.2	16.2	18.5	23.0	23.8	30.2	29.4	37.6	34.8	45.7	40.5	53.8
¾	5.5	6.5	9.2	11.0	15.0	18.2	20.8	26.0	26.7	34.0	33.0	42.5	39.3	51.6	45.6	60.8
1	6.3	7.4	10.5	12.6	17.1	20.2	23.7	29.6	30.6	38.7	39.0	48.3	45.4	58.9	51.9	69.4
1¼	7.2	8.6	12.2	14.6	19.8	24.1	27.6	34.2	35.6	45.0	45.8	56.0	51.2	68.2	60.6	80.8
1½	7.9	9.3	13.2	15.8	21.0	26.2	30.0	37.1	38.6	48.7	47.5	60.8	56.4	74.0	65.4	87.3
2	9.2	10.8	15.6	18.5	25.2	30.6	35.2	43.5	45.2	57.0	55.5	71.5	66.2	87.0	77.0	102.5
2½	10.6	12.5	17.8	21.3	29.0	35.2	40.3	50.2	52.0	65.8	64.0	82.0	76.2	99.7	88.5	117.5
3	12.4	14.6	20.8	24.9	33.7	41.2	47.0	53.5	61.0	76.9	75.0	96.0	89.2	116.5	103.5	137.1
3½	13.7	16.2	23.1	27.6	37.4	47.7	52.0	64.6	67.1	84.7	82.5	103.5	96.0	127.8	109.5	152.0
4	15.8	17.7	25.2	30.2	41.0	50.0	57.1	71.0	73.5	93.2	90.5	116.0	107.7	141.5	125.0	167.0
5	17.8	20.9	31.0	38.2	48.5	59.0	67.5	83.7	86.6	109.8	107.0	137.0	97.0	135.0	112.0	150.0
6	20.7	24.4	34.8	41.7	56.5	69.0	78.8	97.5	102.0	128.5	125.0	161.0	112.5	147.0	131.0	174.0
8	26.0	30.6	43.5	52.0	70.5	86.0	98.5	122.5	128.0	160.5	156.0	200.0	138.0	181.0	161.0	215.0
10	31.4	36.8	52.8	62.8	85.5	104.0	119.0	147.1	154.0	193.2	189.0	242.0	166.0	216.2	193.0	256.2
12	36.8	43.0	62.0	73.5	100.0	122.0	137.5	172.5	179.0	226.0	221.0	284.0	194.0	254.0	223.0	300.0

Figures are B.t.u. per hour per linear foot of Standard Pipe. Insulation is one inch thickness, except for temperatures of 270° and 300° with pipe sizes of 5" to 12", where it is 1½" thick. Table is computed for horizontal pipe but may be used for estimating purposes if pipe is installed vertical.

Thickness of Pipe Insulation Commonly Used on Hot Pipes Indoors.

One Inch Thickness on all pipe sizes with temperature from 100° to 267° (25 lb. gage pressure, steam).

One and One-Half Inches on pipes 4" or larger at temperatures of 267° to 338° (25 to 100 lb. steam), but one inch thick on pipes smaller than 4" at these temperatures.

For Pipe Insulations Not Listed in the Table, Multiply the Tabular Figure for 4-Ply per Inch Asbestos by the Following:

Type Insulation	Temperature of Hot Substance							
	100°	120°	150°	180°	210°	240°	270°	300°
Corrugated Asbestos Eight Ply per Inch	0.905	0.90	0.89	0.88	0.875	0.87	0.865	0.86
Laminated Asbestos 30 to 40 Laminations per Inch	0.685	0.68	0.675	0.67	0.665	0.66	0.655	0.65
20 Laminations per Inch	1.03	1.02	1.01	0.99	0.98	0.97	0.955	0.94
Rock Wool	0.72	0.71	0.70	0.695	0.69	0.685	0.68	0.67

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HEAT LOADS OF HOT INSULATED PIPES

Even though pipes carrying steam or hot water through air conditioned rooms are insulated, the heat given off by them is nearly always too large to be neglected in computing the heat load of the area. The table which appears on the other side of this sheet has been prepared to make it easier for the estimator to determine quickly just how much heat is added by such surfaces to rooms which are to be heated or cooled. The values for the heat quantities shown are per foot of pipe length and while they are for air at 70F, they can be used without serious error for estimating purposes from 60 to 80F.

In the upper part of the table appear the heat quantities for pipe insulated with either 85% magnesia or four-ply corrugated asbestos for temperatures from 100F to 300F. These quantities are in B.t.u. per linear foot per hour and are computed for pipes in a horizontal position. For estimating purposes, however, the same values may also be used for vertical pipes without serious error.

The heat quantities from pipe insulated with eight-ply per inch corrugated asbestos, laminated asbestos with from 20 to 40 laminations per inch, or rockwool can be estimated by using the multiplying factors given in the lower part of the table. These factors when multiplied by the figures for four-ply per inch asbestos appearing in the upper part of the table will give the heat added to the air by pipes covered with these other insulations.

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H & V's REFERENCE DATA—96

EDITORIAL

The Trend Toward Engineering

EACH year we have the pleasure of preparing a review of what has taken place in our field, and of presenting the findings in our January issue. Each year we adopt various methods of collecting information. We never fail to get valuable and interesting suggestions and comments from readers when we ask for ideas as to what should be touched upon in the magazine.

This last year was no exception, and among the letters received was one from Frank L. Myers of Owens-Illinois Glass Company who wrote to suggest the importance of the trend toward engineering as a suitable topic for treatment in HEATING & VENTILATING.

We agree that it is suitable not only for treatment but for editorial comment as well. Moreover, we think that Mr. Myers himself stated the facts so well in a letter that we secured his permission to quote from it. He wrote (the italics are also his):

"As suppliers of an integral part of modern heating and air conditioning equipment, we are watching with interest a trend which ultimately will be the dominating factor in the success of America's next great industry. This trend is toward *engineering*—engineering *within the industry* itself and engineering which might be called *supplementary* thereto.

"Within the industry, the engineer will come into his own, millions of dollars will be spent in research and development—in conceiving new ideas and exploding time-worn theories and traditions.

"Just as the automotive industry forced supplementary engineering development in roads and highways, refining, rubber, metals and textiles—so is the heating and air conditioning industry forcing an intensive scientific study and development of building materials, structures, insulation, refrigeration, fuels, metals, etc.

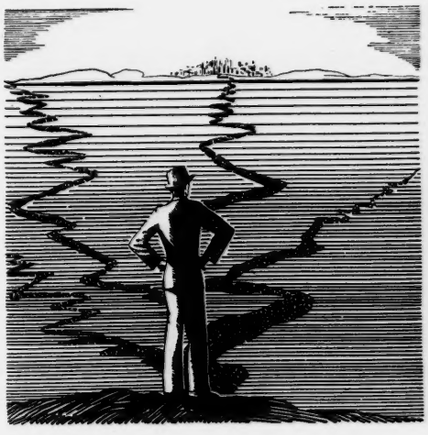
"In addition to *technical* engineering, modern heating and air conditioning is forcing *sales* engineering. A plan of distribution and merchandising—quite foreign to old practices in an industry that has been divided against itself—is being shaped along lines well established and proven in other fields. Selling will be on a new plane, geared to modern techniques. The present diversification of retail outlets for heating and air conditioning will be melded without class distinction and we will have an industry prepared by sound technical, manufacturing, selling and installing engineering to meet the demands of a comfort-loving public."

The principal place where we differ with the view expressed is that the future tense is used to such an extent. To our mind not only is the trend plainly toward engineering but to a considerable extent engineering has already moved in—to nothing like the extent which it may be expected to do so in the future—but we are on the way even now.

It seems to us that this is a point easily demonstrated. For one thing we know of the great increase in the actual numbers of engineers engaged in the work of this industry, for our own field surveys show this beyond a doubt. For another, one has to but look at the scope of topics now embraced in air conditioning to realize that coordination of the air conditioning functions must be accomplished by engineering. More evidence comes from the steady parade of new products — materials, parts, and complete machines — which are reaching the market with the engineer influence apparent in every detail. Leaders are publicly stating that they are limited even now by their ability to secure competent engineering help. The technical schools and colleges are reporting that engineering students are clamoring for organized classes in heating, refrigeration, air conditioning. Hundreds of young engineers have entered the industry; hundreds more are hoping to do so. Even now the research laboratories are pouring out both scientific findings and new products. More of these laboratories are being organized each year and they are staffed almost altogether by engineers.

Evidence of our present relative position on engineering can be produced also by briefly considering the situation existing only ten years ago. Engineers were pretty scarce in this industry then, competent ones even more so, although the building industry was booming. As simple a unit as the B.t.u. was none too well understood except among a very few. Refrigeration was something about which the average engineer in this field was more aghast than well informed. And no one cared very much either. There were but few laboratories, products were well standardized, selling methods were static. The electrical manufacturing companies, the utilities, and the new-found radio and aeronautical interests were the magnets which were drawing young engineers and toward which much of the competent engineering talent gravitated. Rare was the young man who saw enough future in heating to attempt to make an engineering career out of it. We remember well being cautioned not so many years ago to keep in mind editorially that it was not well to take too much technical understanding for granted. Now we observe with what glibness young men in the industry speak of the refrigerants, of orifices, of heat transfer, of absorption, of surface tension, of wet and dry bulb temperatures, and of all the other technical jargon that goes to distinguish this field. If they don't understand these terms and ideas they certainly do succeed in creating the impression that they do at any rate. All this seems to us like good evidence that all of the trend toward engineering is not in the future. Substantial amounts of engineering are with us right now.

Let no one suppose that because we thus call attention to the present situation we do not agree with Mr. Myers' thought that there is a great future for engineering in this industry. We certainly believe that there is one, and one which very few now engaged in the industry fully appreciate. We doubt seriously if the prophet who can correctly forecast either the extent or the major paths of this future has yet arisen among us. When he comes we should know him at once, for like all prophets he will be lightly regarded and scoffed at by all "practical" men except the little group who, like him, are ahead of their fellows in their thinking. We need more of this prophetic thinking for its inspirational value and for its exploratory nature.



ABSTRACTS of Current Papers, Books and Pamphlets

Codes for Exhaust Systems and Testing and Measuring Air Flow

The American Foundrymen's Association has recently approved and published two Tentative Codes of Recommended Practices developed by its Industrial Hygiene Codes Committee. These codes are the first two in a series of some 25 codes being developed to assist in the standardization of dust eliminating methods and improvement of shop operating conditions in the foundry industry. The two codes which are now available are: 36-27—Tentative Code of Recommended Practices for Testing and Measuring Air Flow in Exhaust Systems, and 36-28—Tentative Code of Recommended Practices for Grinding, Polishing and Buffing Equipment Sanitation.

Code 36-27 is prepared to aid in the standardization of the general type of instruments and technique employed in determining the volume and velocity of air flow in exhaust systems. It covers the application and testing technique for pitot tubes, inclined and vertical manometer gages, revolving vane type anemometers and swinging vane type direct reading velocity meters. The 13 figures contained in this code add greatly to the methods described.

Code 36-28 describes recommended practices for the ventilation of all grinding, polishing, buffing, scratch brushing or abrasive cutting-off wheels, and grinding or polishing straps or belts. A series of definitions is followed by sections on applications for hood and branch pipe requirements, design of exhaust systems, testing exhaust systems and hood and enclosure design and minimum air velocity required. The numerous illustrations will be found helpful in aiding plant engineers in designing effective equipment to meet plant requirements, especially for the smaller foundries.

[*Tentative Code of Recommended Practices for Testing and Measuring Air Flow in Exhaust Systems. Preprint 36-27. Tentative Code of Recommended Practices for Grinding, Polishing and Buffing Equipment Sanitation, Preprint 36-28. Published by the American Foundrymen's Association, Inc., 222 W. Adams St., Chicago. Heavy paper cover; 8½ x 11 in.; price each $2.*]

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Refrigerating Data Book

The third edition of the Refrigerating Data Book differs greatly from the previous editions. More than half of the chapters are entirely new and have been written by authors not in the previous editions. Of the remaining 16 chapters, 9 have been revised or rewritten by their original authors or other experts. The makeup of the book has also been changed, there being four major subdivisions instead of five as before. Approximately 50 pages have been added to the technical section.

In order to make the book of more help to the beginner, a general introduction has been added. In this section is discussed the scope of the refrigeration field, definitions of heat and temperature, the elementary refrigeration cycles, definitions of various thermodynamic terms, and theories of application.

New material on the following subjects has also been added: air conditioning, ventilation, food storage conditions, commercial systems, evaporators, cooling towers, electric motors, refrigeration service, fans, ducts and air system, control systems, air conditioning computations, and small air cooling systems. Extensive new material has been introduced into chapters dealing with thermodynamics, and in a section on the open absorption system.

The four major sections of the book are entitled Principles, High Side, Low Side, and Applications. In the section on Principles is discussed the thermodynamics of refrigerating cycles, refrigerants, heat transmission, air conditioning, and foods and storage. The High Side of the refrigerating system section takes up domestic refrigerators, condensation units, commercial systems, water cooling and tower equipment. The third section on the Low Side of the refrigerating system deals with refrigerating servicing, installation, pipe and piping, evaporators, fans, air systems, and automatic controls. In the section on Application is discussed among other subjects air conditioning practice, packing house refrigeration, ice manufacturing, refrigeration statistics. A table of conversion factors and symbols is also included.

[*"Refrigerating Data Book and Catalog, 1937-38." Published by the American Society of Refrigerating Engineers, 37 W. 39th St., New York. Cloth bound; 6½ x 9½ in.; 519 pages in technical section; 104 pages in catalog section; 20 pages in membership list section; price, $4.*]

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The Professional Engineer

This monograph is one of a series dealing with the present status of certain professions in the United States. The purpose of the series is to gather together the more pertinent data pertaining to these professions which are at the present time scattered throughout a wide number of publications. Over one-third of the contents of this book is taken up by a discussion of engineering education. Some of the subjects covered in this section include evolution of engineering colleges; the curriculum; graduate training; engineering students; engineering faculties, and samples of engineering teachings.

Because of the great importance of the national associations to the profession, a rather complete discussion of them is included. Among the subjects taken up are the number and nature of national associations and four typical examples. The third section of the book deals with the number of engineers and the demand for their services while the fourth discusses salaries of engineers. The last section of the book treats the trends in engineering.

[*"The Professional Engineer," by Esther L. Brown. Published by the Russell Sage Foundation, New York. Stiff paper cover; 5½ x 8 in., 86 pages; price, 75c.*]

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Architectural Drawing and Detailing

It is the purpose of this book to present the general principles, practices, and technique of architectural drawing and detailing in such a manner as to serve beginning students, laymen, and draftsmen who are in the need for practical information on this subject. The book should be of considerable help to men entering the heating field as well as to the older men in the field who feel the need for information regarding this work of the architect. The book is divided into four sections entitled as follows: architectural drawings; architectural detailing; rendering in pen and ink; landscaping.

Heating men will probably be more interested in the section on architectural detailing than in the others as the subjects discussed in this section include standard details for house framing; typical detailing, specifications, and detail problems.

[*"Architectural Drawing and Detailing," by J. R. Dalzall and James McKinney. Published by the American Technical Society, Chicago, Ill. Cloth bound; 5½ x 5½ in.; price, $2.*]

14 Guides to Financial Stability

In an analysis of 60 different lines of business, Roy A. Foulke, manager of the Analytical Report Department of Dun & Bradstreet, has published 14 important ratios based on a study of 47,980 enterprises over the period of 1931-35 inclusive. The brochure, which is entitled "Fourteen Guides to Economic Stability," has drawn from the operating experiences of 35 manufacturing lines of activity, 18 wholesaling lines, and 7 retailing lines. Most of the 47,980 concerns which were studied had a tangible net worth of $50,000 or more. Mr. Foulke, in reducing his five-year study of the profit and loss factors in management, offers measuring sticks whose gages are determined on actuarial experience. Included in the types of wholesalers studied are jobbers of heating and plumbing supplies.

The booklet supplements Foulke's volume "Behind the Scenes of Business" published in 1935 and revised in 1936.

[*"Fourteen Guides to Financial Stability," by Roy A. Foulke. Published by Dun & Bradstreet, Inc. Paper-bound; 7 x 10 in., 44 pages. Available on request.*]

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Humidity in House-Heating

A pamphlet prepared for the general public to direct its attention to the fact that the air in houses during much of the artificial heating season is excessively dry. It points out the dangers of excessive air dryness and outlines the essential facts on humidity and house-heating. According to the author, the main object of this booklet is not only to further the cause of health but to promote the more efficient employment of fuel used in the heating of Canadian homes, offices, and factories. The first section deals with air moisture and the cause of air dryness in houses; the desirable relative humidity in houses and the measurement of relative humidity. The second section takes up various typical humidification equipment. A section in the appendix of the book tells how to determine the relative humidity by the use of an ordinary house thermometer.

[*"Humidity in House Heating," by E. S. Martindale. Obtainable from the Dominion Fuel Board, Motor Building, Ottawa, Ontario, Canada. Heavy-paper cover; 5½ x 7½ in.; 38 pages; price 5c*].

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Fan Comparison Chart

This booklet is made up of three fair comparison charts for comparing the various type fans offered by different manufacturers. The table is so arranged that fans of like ratings are arranged in the same horizontal columns. The fans of 12 manufacturers are listed. The first chart deals with single inlet, single width, multiblade and non-overloading fans. The second deals with double width, double inlet, multiblade fans, while the third takes up double width, double inlet, non-overloading fans.

[*"A Fair Comparison Chart of Various Commercial Ventilating Fans." Published by the National Association of Fan Manufacturers, 5-208 General Motors Bldg., Detroit, Mich. Revised to May 25, 1936. Paper; 8½ x 11 in.; 4 pages.*]

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Coke in 1935

The use of coke for domestic purposes increased steadily from 1921 to 1933, each year, with one exception, showing a gain over the preceding year in the tonnage of this fuel used for domestic heating. In 1934, however, the tonnage dropped as compared with 1933 and from reports now available the 1935 tonnage was considerably under the 1934 total.

An explanation of this decline in sales with returning prosperity which contrasts peculiarly with increasing sales during the depression is found in the Bureau of Mines publication, "Coke and By-Products," recently published. The reasons for the drop given by the experts in the Bureau of Mines are (1) a greater industrial activity which results in coke producers using more of their coke for their own processes; (2) increasing installations of domestic and commercial stokers; (3) increasing competition from natural gas; (4) declining prices of anthracite; (5) increasing competition from soft coal, resulting in higher priced coke; (6) more competition from cheap trucked coal —the last being merely a nice way of referring to bootleg coal.

Complete statistical data and text with some relating to coke and its byproducts are found in the bulletin.

[*"Coke and Byproducts," by W. H. Young, H. L. Bennit, and L. N. Plein. Published by the U. S. Bureau of Mines. Paper bound, 5⅞ x 9⅛ in.; 44 pages. Obtainable from the Superintendent of Documents, Washington, D. C.; price, 10 cents.*]

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Thermodynamic Properties of Steam

Approximately six years ago, the Keenan steam tables were first published and since then they have become the recognized source of data relating to the physical properties of steam and water. During the past six years, however, the available data on water and steam have been considerably increased due to the completion of various investigations in this country and abroad. The results of these investigations have filled in large gaps in previous tables and have also extended the regions formerly investigated. The present tables include all of the data in the earlier book together with the results of the later investigations.

In the introduction is a complete description of the temperature scale and general equations dealing with the property of steam and water. Following this is a table of saturation temperatures occupying six pages, saturation pressures also occupying six pages. A table on super heat vapor occupies approximately 34 pages. The fourth table gives the properties of the compressed liquid while tables 5, 6, and 7 give the properties of solid vapor saturation, viscosity, and the heat conductivity, respectively. Table 8 lists a large number of conversion factors and table 9 gives four thermometer calibration formulas. A temperature entropy chart in two colors is also included. In the back pocket of the book is a large Mollier chart.

[*"Thermodynamic Properties of Steam," by Joseph F. Keenan and Frederick G. Keys. Published by John Wiley and Sons. New York. Cloth bound; 7 x 10 in.; 89 pages; price, $2.75.*]

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Federal Home Financing

The Federal Home Loan Bank Board has published an attractively gotten together booklet entitled "Safeguarding the Nation's Homes," describing the organization, activities, and accomplishments of some of the various federal bureaus and divisions dealing with home financing. These include the Home Owners' Loan Corporation, the Federal Home Loan Bank System, the Federal Savings and Loan Associations, and the Federal Service and Loan Insurance Corporation. The Federal Housing Administration is not included, but in the back of the booklet are listed all of the federal agencies concerned with housing and home financing and including such organizations as Federal Housing Administration, Farm Credit Administration, Resettlement Administration, etc.

[*"Safeguarding the Nation's Homes—Federal Protection for Thrift and Home Ownership." Thirty-two pages; bound in heavy paper; 6 x 9 in. Available from the Federal Home Loan Bank Board, Washington, D. C.*]

BRIEF REVIEWS

ARC WELDING LESSONS. A new edition of these well-known lessons on arc welding. Purpose is to give welding operators a thorough working knowledge of the practical applications in use of arc welding. Volume contains 44 lessons. [*Lessons in Arc Welding. Published by The Lincoln Electric Co., Cleveland, Ohio. Paper bound; 8½ x 11 in.; 130 pages; mimeographed; price, 50c*].

STANDARD TEST CODE FOR FANS. This is the second edition of the test code and was prepared by a joint committee of the National Association of Fan Manufacturers and the American Society of Heating and Ventilating Engineers. [*Standard Test Code for Disc and Propeller Fans, Centrifugal Fans and Blowers, Second Edition. Published by the National Association of Fan Manufacturers, 5-208 General Motors Bldg., Detroit, Mich. Paper cover; 19 pages; 8½ x 11 in.; price 25c.*]

1936 NDHA PROCEEDINGS. Includes a list of the members of the Association and the proceedings of the 27th annual convention of the National District Heating Association. [*"Proceedings of the National District Heating Associaton." Published by the National District Heating Association, 1317 Spruce St., Philadelphia, Pa. Cloth bound; 6 x 9 in.; 289 pages; price, $5*].

GRINDABILITY OF COALS. Tables of grindabilities and analyses of many of the coals mined in the United States, Canada, and other countries. Persons concerned with the burning of pulverized coal should find these tables of interest. [*Tables of Grindabilities. Published by The Babcock & Wilcox Co., 85 Liberty St., New York; free.*]

COAL APPLIANCE DIRECTORY. An English directory of solid fuel-burning appliances and associated equipment. Includes list of 1000 manufacturers; a classified list of fuel-burning appliances and associated equipment; a register of proprietary names; who's who of notable persons in the English coal industry, and standard technical data on solid fuels. [*The Black Book, compiled by The Combustion Appliance Makers' Association. Published by Morgan Brothers, Ltd., 28 Essex St., Strand, London, W.C.2; 7/6d.*]

UNDERWRITERS' INSPECTED APPLIANCES. A list of inspected gas, oil, and miscellaneous appliances which have been passed by the Underwriters' Laboratories. [*"List of Inspected Gas, Oil, and Miscellaneous Appliances," December, 1936. Published by the Underwriters' Laboratories, Inc., 207 E. Ohio St., Chicago. Paper cover; 119 pages.*]

SOCIAL SECURITY ACT. Two booklets dealing with the regulations relating to taxation under the Social Security Act. The first booklet deals with the excise tax imposed on employers by Title IX while the second deals with the employes' tax and the employers' tax imposed by Title VIII. [*"Regulations 90 Relating to the Excise Tax on Employers," and "Regulations 91 Relating to the Employee's Tax and the Employers' Tax." Published by the U. S. Treasury Department, Bureau of Internal Revenue. Obtainable from the Superintendent of Documents, Washington, D. C. Paper cover; Regulations 90 has 66 pages and Regulations 91 has 56 pages; price 10c each.*]

UNEMPLOYMENT COMPENSATION. An official explanation of the Federal-State program for unemployment compensation. [*"The Federal-State Program for Unemployment Compensation," December, 1936. Published by The Social Security Board, Washington, D. C. Informational Service, Circular No. 5; paper cover; 15 pages; 4 x 9 in.*]

UNEMPLOYMENT COMPENSATION. Questions and answers concerning the unemployment compensation provisions of the Social Security Act and State Unemployment Compensation Laws. [*"What You Should Know About Unemployment Compensation," November, 1936. Published by The Social Security Board, Washington, D. C. Informational Service, Circular No. 2; paper cover; 36 pages; 4 x 9 in.*]

OLD-AGE BENEFITS. Some questions and answers concerning the old-age benefits provisions of the Social Security Act. [*"Federal Old-Age Benefits," December, 1936. Published by The Social Security Board, Washington, D. C. Informational Service, Circular No. 3; paper cover; 18 pages; 4 x 9 in.*]

GAS AIR CONDITIONING. Discusses the progress made in summer air conditioning with gas during the past year. Describes the operation of the silica gel conditioner unit and the commercial gas-fired ice machine. Gives some operating cost data on gas-fired ice machines. [*"Summer Air Conditioning with Gas." Interim Bulletin No. 29, published by the Commercial Section, American Gas Association, 420 Lexington Ave., New York. Paper cover; 4 x 9 in.; 22 pages.*]

DIRECTORY OF LABORATORIES. Two lists of testing laboratories. The first deals with commercial laboratories and the second with college research laboratories. The list has been arranged alphabetically in accordance with the geographical locations of the laboratories. Numerical references are used to indicate the types of commodities tested and alphabetical references indicate the nature of the tests. [*Directory of Commercial Testing and College Research Laboratories. Miscellaneous Publication M125, published by the United States Department of Commerce, National Bureau of Standards. Obtainable from the Superintendent of Documents, Washington, D. C. Heavy paper cover; 55 pages; 7½ x 10½ in.; price 15c.*]

PROXIMATE COAL ANALYSES. Contains proximate coal analyses on the majority of mines in the United States, arranged alphabetically by the name of the mine, then followed by the location, operator, selling agents, and dates of the analyses. An alphabetical list of coal operators is also included. [*"Mac's Proximate Coal Analyses," compiled by W. C. MacQuown. Published by Coal Information Bureau, Inc., Union Trust Bldg., Pittsburgh, Pa. 100 pages; 6¼ x 10¼ in.; price $5.*]

FLOW METER HANDBOOK. The object of this book is to familiarize the reader with correct design, installation, and operation of the flow meter. Particular attention is paid to a detailed description of the methods used in the correct design of the differential pressure producing element known as the thin plate orifice. Takes up measurement of the flow of steam, water, liquid air, and gas. [*Brown Flow Meter Engineering Handbook, 1936 edition, by L. Gess and J. O. Feldmark. Published by The Brown Instrument Co., Philadelphia, Pa. Cloth bound; 8 x 10½ in.; 162 pages; price $2*].

PIPING DESIGN MANUAL. An excellent book on design of piping for flexibility. The main purpose of the book is to spare the engineer much arduous and time consuming effort in obtaining adequate design without the waste of over-safe guessing. [*Pittsburgh Piping Design Manual, by E. A. Wert and S. Smith, with G. Sinding-Larsen and G. W. Petrie, Jr. Published by the Pittsburgh Piping and Equipment Co., Pittsburgh, Pa. Heavy cardboard cover; 8½ x 11 in.; 70 pages; price $3*].

COAL SALES MANUAL. A number of sheets containing a wide variety of information on servicing the small coal heating plant. Lists the causes of complaints; tells how to make a complete furnace inspection; how to fire a heating plant; how to check a chimney; how to check the operation of a stoker, and how to remedy common troubles in stokers. [*Sales Manual. Published by the Franklin County Coal Corp., 135 S. La Salle St., Chicago. 12 sheets; 8½ x 11 in.*]

COAL RESEARCH. Resume of research of progress in coal and coal utilization. Report covers 36 subjects with stoker studies receiving the most attention in so far as the number of projects is concerned. The report also lists recent publications concerned with coal and its utilization. [*Résumé of Current Research in Coal and Coal Utilization, December, 1936. Compiled by Bituminous Coal Research, Inc., Southern Bldg., Washington, D. C. Heavy paper cover; 6 x 9 in.; 37 pages; price 50c*].

NEWS OF THE MONTH

Ultra-Violet Floodlight Rays Form Invisible Barrier for Air-Borne Germs, Experiments at Harvard Show

BOSTON—A new type of ultra-violet floodlight, the rays from which form an invisible barrier through which air-borne disease bacteria cannot pass has been developed at the Harvard University School of Public Health. This floodlight, which promises to curb influenza, common winter colds, and the more dangerous air-borne diseases, was developed by William F. and Mrs. M. W. Wells. By its means a barrier of invisible rays may be thrown across a hospital corridor, dividing the infectious dseases in one wing from other parts of the building and preventing their bacteria from passing. Nurses can walk through, but infections cannot float through.

A replica of a railroad car has been built with wallboard to test the possibilities of its use therein, thus cutting down the danger of spreading infections from one city to another.

These experiments have grown out of the discovery at the Harvard School of Public Health, announced last July, that influenza can be transmitted by the air alone, and that the right use of ultra-violet rays is a complete protection against this source of influenza. This was proof that the air itself can carry infection.

The recent experiments were made by physicians wholly outside the School of Public Health, and are the first large scale application of "sanitary control of the air."

Two ingenious devices, an "infector" and an "infectee," make the tests possible—the "infector," the size of two superimposed clenched fists, sprays germs into the air; the "infectee," a small, old-fashioned churn, breathes in the germs. When the ultra-violet rays are on, in any position, these two machines measure and standardize the germ killing effects.

Goal of the Harvard experimenters is not only influenza and colds, but the more serious situation covered in the annual United States public health report that 85% of all deaths due to infection are from those contracted in the nose and throat. It is hoped to control many of these infections by air sanitation in public places, such as halls, theaters, railroad stations and railway and street-cars, just as water and milk sanitation have decreased typhoid.

The floodlights are long, slender quartz tubes, with aluminum reflectors to direct the rays. The beams can be kept away from the body and the eyes. Other diseases beside those before mentioned which may in part be spread through the air include measles, whooping cough, smallpox, meningitis, mumps, diphtheria, scarlet fever, infantile paralysis and psittacosis. In a sense this is air conditioning by means of the ultra-violet ray, a new development in the science of air conditioning. With such equipment, combined with the control of temperature, humidity, and air changes possible with mechanical air conditioning, a hospital may eventually be the most healthful place in which to live.

N. Y. Chapter Hears Talk on Humidity Controls

NEW YORK—Ralph R. Chappell, chief physicist and executive head of the engineering department of Julien P. Friez & Sons, Baltimore, addressed the local chapter of the ASHVE here January 18, Mr. Chappell, who has been engaged in problems involving humidity measurement for nine years and who was formerly associate professor of physics at the University of Richmond, spoke on the Kinetic Theory of Gases. Kenneth E. Whitney, development engineer of the air conditioning instruments and controls department of the same company, spoke on humidity measurement and control.

N. Y. Contractors Plan Supper-Dance

NEW YORK—The Association of Heating Contractors of Greater New York, Inc., will hold its third annual supper, dance, and follies show at the French Casino here March 3. Newly-elected officers of the association are: president, P. Wolf; vice-president, J. Kessler; treasurer, B. Spiegel; secretary, J. C. Weare; chairman of board of directors, J. Miller. The following were elected to the Board of Directors: D. Brown, A. Hering, W. Marshall, L. Farbman, E. Gruen, A. Brown. Those elected to the Membership Committee were: Alfred Hering, Jack Miller, and Max Weiss, while J. Kreiner, E. Gruen, S. Moskowitz, S. Dickstein, and A. Brown were elected to the Entertainment Committee.

The third annual Christmas luncheon of members of the staff at the main office of Pierce Butler Radiator Corp., Syracuse, N. Y., December 23. At the luncheon bonuses and a wage increase averaging 10% was announced by President Blair A. McFarlane, shown standing at the extreme right.

Warm Air Furnace Manufacturers Hold Most Enthusiastic Meeting in History of Association; Officers Reelected

CHICAGO—Probably the most optimistic and enthusiastic convention of the National Warm Air Heating and Air Conditioning Association yet held was that at the Hotel Stevens here December 15-17. The enthusiasm was caused by the considerable success which warm air has been meeting in connection with winter air conditioning in residences and the optimism was due to the outlook for 1937 which is exceedingly bright for the industry.

In his presidential address, W. L. Rybolt stressed the importance of the association to its members and discussed the needs of the association under the headings research, legislation, education, and publicity. He commented on the research work done at the University of Illinois and by the association's research committees and then turned to the law taxing undistributed earnings, concluding that this law is manifestly unfair and unjust. He mentioned the Social Security law and said that the question is not how much the increased cost would affect the industry but how much the increase would be.

Bennett Chapple, vice-president, The American Rolling Mill Co., spoke on "What an Opportunity."

Dana W. Norris, president, The Lennox Furnace Co., discussed warm air heating and air conditioning installations from the dealers' standpoint. He suggested that though prefabricated fittings cost more than those made in the shop the difference in price was more than made up by the greater profit the mechanics brought in by being free during the installation period.

Arthur R. Lamneck spoke on some of the current legislation affecting the industry, such as the Robinson-Patman Act and the Social Security Act, and devoted some attention to current legislation.

Prof. J. D. Hoffmann, Purdue University, chairman of the association's code committee, reported that the revised installation code for mechanical warm air systems had been completed and was ready to be sent to the printer.

Prof. A. P. Kratz, University of Illinois, outlined the problem of "The Calculation of Cooling Load for Installation of Summer Cooling Systems." He stated that in calculating the total cooling loads two general practices have been followed—one based on the idea that the indoor temperature follows instantly the increases and decreases of the outdoor temperatures, and the other based on the thought that when the outside temperature changes the effect is not transmitted instantly to the inside, but lags to a degree, with the inside temperature reaching the extreme about two and a half hours after the outside temperature has reached the extreme. Plotting the calculated cooling load for both of these practices, he pointed out the time shift in the peak load under the second method of figuring.

He concluded by pointing out that since for light construction the difference between the loads calculated by the instantaneous transmission method and the method involving the lag factor did not exceed 500 B.t.u. for extreme temperatures, the lag factor could be disregarded, so that the cooling load calculations can be based on the instantaneous transmission theory.

S. Konzo, special research associate, University of Illinois, reported on summer cooling in the research residence, using water at temperatures of 46 and 52F. He summarized the work carried out during the past five years, using ice cooling, night air, mechanical refrigeration, water at 58F, and the current research using water at 46 and 52F as media for summer cooling. He said that although this summer was the most extreme in the history of Urbana, the results obtained with the cooling system were satisfactory. He listed advantages of using water as the cooling medium for summer cooling as: simplicity; low service cost; low operating cost; quietness in operation; simple to control; the water used in cooling can be used for other purposes; and the system does not add any heat to the house. Disadvantages included: finding a supply of low temperature water available; cannot be used if the water temperature exceeds 60F; more heat transfer surfaces are needed; larger fans needed; humidity is high with warm water; use of large quantities of water may result in reducing the pressure at the other outlets.

Frank G. Herman, Furblo Co., spoke on "Combined Salesmanship and Engineering Imperative." The address was devoted to the theme that the problem is one of educating dealers in engineering rather than in salesmanship. He recommended manufacturers assisting whole-heartedly in educating dealers and making them engineering specialists.

Frank L. Myers, Owens Illinois Glass Co., spoke on "Servicing Today a New Problem." He said that the problem of servicing was complicated by the use of automatic fuel burners and that the question has arisen as to who is to do servicing in the heating plant—the manufacturer of the heater or the manufacturer of the burner. He predicted that in the future service stations capable of handling any problem in air conditioning may come into existence.

C. D. Leiter, F. E. Myers & Bros. Co., had as his subject summer air conditioning using well water and he suggested the cooperation of the warm air industry with the pump manufacturers in adapting equipment to year-round use.

The officers were unanimously reelected for another year. They are: president, W. L. Rybolt; first vice-president, L. R. Taylor; second vice-president, C. A. Olsen; managing director and treasurer, A. W. Williams. The board of directors consists of R. W. Blanchard, F. G. Sedgwick, Buel Allen, and C. Ackerson.

The Chicago reception committee was composed of R. J. Lorenz, T. R. Mackin, E. J. Schmike, D. C. Ellison, C. W. Nessell, G. R. Folds, C. B. Magrath, D. E. Cummings, A. R. Meiche, and E. C. Carter.

Wants State Supervision of District Steam Service

BOSTON—Representative Albert E. Morris of Everett has asked the legislative committee on power and light to pass legislation subjecting the Edison Electric Illuminating Company's underground steam operations to the same supervision as in the electric field. He told the committee that the Edison company is now selling 1,000,000 lb. of steam to customers without any state supervision and that the company now has more than 300 customers for this product. He believed in the view of the volume of business done in steam that the rates and other phases of the business should be supervised.

Navy to Cool Gun Turrets

WASHINGTON—The two 35,000-ton battleships to be built by the navy will have a speed of 26 to 27 knots and carry three turrets containing nine 16-in. guns or twelve 14-in. guns.

These and other details were disclosed at a press conference January 14 by Secretary Claude A. Swanson, although much information was withheld for reasons of naval secrecy.

That each turret can now hold four instead of a maximum of three big guns was regarded as an indication that the navy had developed refinements in refrigeration and air conditioning that would offset the great heat generated in the operation of batteries of four, but officials maintained a close silence concerning this development, which appeared to be exclusive for the United States.

Oil Burner Men Elect Officers

BOSTON—Officers of the Boston Oil Burner Associates for 1937 were elected at the January monthly dinner and meeting, as follows: president, Kai Laybourn; vice-president, J. E. Gould; secretary-treasurer, Fred N. Beckwith; executive committee, Chas. Soper and Harry C. Mayo.

A.C. to be Used in Fighting Respiratory Diseases

BOSTON—If air conditioning can accomplish anything for improvement of health it should be in the field of respiratory diseases, such as pneumonia, influenza, and common colds, Dr. Philip Drinker, professor of industrial hygiene at the Harvard School of Public Health, declared in a free Sunday afternoon lecture at the Harvard Medical School January 10. Professor Drinker said that there is no evidence as yet that air conditioning makes people any healthier, although it certainly has increased the comfort of humanity immeasurably. But in the war on respiratory diseases it should prove helpful.

Air conditioning can duplicate the climates of the world, and a survey of these has indicated that the climate of the northeastern United States and those of England, northern France, Germany, Scandinavia, southern New Zealand, southern Australia, and South Africa are the best as viewed by the results of civilization among the earth's peoples. "Nature has treated us rather well here in New England," he said. "Even in the hottest summer we do not have to endure long heat spells, or protracted droughts. Our climate is noted for its many changes, a fact which may annoy us at the time, but which now is recognized as stimulating."

Office Building A.C. Subject of Chicago Chapter Meeting

CHICAGO—The customer's opinion of air conditioning—its advantages and disadvantages—was presented to the members and guests of the Illinois Chapter, ASHVE, at its meeting on January 11, Hotel Sherman, by H. J. Rogan, assistant chief engineer, the Estate of Marshall Field. 110 were present. Mr. Rogan's paper was presented under the title of "Building Owning Industry Views Air Conditioning Industry." After describing the setup of his organization as representative of the building owning industry, he explained that space was his commodity and his business depended upon selling it and keeping it sold. To do this the building owner will do everything practicable—even air condition. The owner is happy to see air conditioning go in for the tenant who wants it and is willing to pay for it. It gives the tenant a personal interest in his space. Handicaps, though, exist. Power is not normally available near rentable area. The same is true of steam, water, and waste. The obvious solution to the water and waste problem, in Mr. Rogan's opinion, is the use of evaporative condensers. The point, however, is that these costs involved must be figured against the space which in turn must be figured from a five-year lease viewpoint and not a 50-year building life. Mr. Rogan feels that some air conditioning salesmen as well as air conditioning engineers overlook this.

The owner also considers any investment from the viewpoint of higher utilization. Will it make available space that otherwise could not be rented because it is undesirable? The audience was asked to answer that one as far as air conditioning is concerned.

Another yardstick of the owner in making an investment is the protection of potential income. If air conditioning does that, Mr. Rogan stated that there would be no hesitation in spending the money for it.

He felt that the introduction of air conditioning to many office buildings was not sound because it is coming in the form of scattered installations throughout a building and the owner will soon wake up to find his office building with machine rooms all over the place. He does not think that room units are the answer. He showed how they do not protect the owner's potential income and felt that the best such protection is in the installation of a central system.

District Heating Contest

BOSTON—A competition open to members of the National District Heating Association who have, or will have, joined between January 1, 1934, and May 1, 1937, has been announced here. Cash prizes of $50, $25, and $10, and a fourth prize of one year's free membership in the NDHA are offered for an original paper of not more than 2000 words on any subject having to do with the generation, distribution or sale of district steam. Wide leeway in treatment of the subject matter is permitted and may include any theory, anecdote, experience, or even a dream, just so the subject matter is district steam.

Judges for the competition are announced as C. H. B. Hotchkiss, Editor, HEATING & VENTILATING; M. D. Engle, President, NDHA; and R. M. Nee, Chairman, Membership Committee, NDHA. The competition closes on May 1 and the winners are to be announced at the national convention of the Association to be held in Detroit, May 25 to 28.

Coal Group Widens Scope

CHICAGO—The National Coal Association has established an engineering department as a further step in its active promotion of coal markets and with a view of coordinating and augmenting its various efforts in this direction. The department will be in charge of C. A. Reed, a mechanical engineer with practical experience in the merchandising of bituminous coal.

Oil Burner Convention Program Announced

NEW YORK—The 14th National Oil Burner and Air Conditioning Exposition to be held at Philadelphia March 15-19 will be the largest and most representative in the history of the industry. Two months prior to the opening date, G. Harvey Porter, managing director of the Oil Burner Institute and of the show, reported that 70% of the available floor space at Convention Hall had been taken, representing more spaces than were occupied at Detroit, scene of the industry's largest show to date.

Among the organized groups lending official support to the program are the Air Conditioning Manufacturers Association, The Electrical Association of Philadelphia of which the oil burner group is a part, and the American Petroleum Industries Committee.

The official convention program follows:

MARCH 15

10 a. m.—Executive Committee meeting.
2:30 p. m.—Meeting of Board of Directors.
7 p. m.—Official show opening.
8:30 p. m.—Public air conditioning lecture. Will be broadcast.

MARCH 16

9:30 a. m.—Engineering and Technical Session, Harry Tapp, chairman.
Fuel Oil Specifications.
Technical Aspects of Air Conditioning.
Health Angle of Winter Conditioning.
3 p. m.—Group meeting. Distillate burner manufacturers.
4 p. m.—Group meeting. Industrial burner manufacturers.

MARCH 17

9:30 a. m.—Financial and Accounting session, Frank H. Dewey, chairman.
Elements of Cost in Oil Burner Manufacture, R. T. Moore, certified public accountant.
2:30 p. m.—Marketing session, B. H. Markham, chairman.
Oil Marketing.
Burner Marketing.
Legislation As It Affects Marketing.
8:30 p. m.—Public air conditioning lecture.

MARCH 18

9:30 a. m.—Manufacturers conference, E. P. Bailey, chairman.
10 a. m.—Dealers session.
3:30 p. m.—Annual meeting, Oil Burner Institute members.
4:30 p. m.—Board meeting, new directors.
7 p. m.—Banquet and dance.

MARCH 19

10:30 a. m.—Annual meeting OBI Associate members, J. R. Murphy, chairman.
3 p. m.—Conference on Regional meetings.
8:30 p. m.—Public air conditioning lecture.

55 More A.C. Cars

BOSTON—Included in a $1,820,000 order for new equipment and rails by the Boston & Maine and Maine Central railroads are 55 additional deluxe air conditioned coaches. Twenty of the coaches will be built by the Pullman Co. at Worcester, Mass., at a cost of $40,000 each. Thirty of the B & M and five of the Maine Central's all-steel coaches will be modernized and air conditioned in the company's shops at Concord, N. H., and Waterville, Me.

Welding Foundation Formed

CLEVELAND—The James F. Lincoln Arc Welding Foundation, a fund dedicated to the encouragement of study and research for the benefit of the arc welding industry, has been established by vote of the Lincoln Electric Company's board of directors. The foundation is named in honor of the company's president. One of its primary functions will be the stimulation of original design in order that arc welding processes may be more widely utilized in modern day fabrication.

Principal direction of the Foundation's work will be given by Dr. E. E. Dreese, head of the Department of Electrical Engineering at the Ohio State University. Other trustees who will serve with Doctor Dreese on the Foundation are W. B. Stewart, member of the Cleveland Bar, and H. R. Harris, vice-president, Central National Bank of Cleveland.

Fan Makers Hold Annual Meeting

DETROIT—J. M. Frank, president of the National Association of Fan Manufacturers, in his report submitted at the association's annual meeting January 15, indicated that the Standard Test Code for Disc and Propeller Fans. Centrifugal Fans and Blowers was one of the contributing factors in helping to establish standards for the air conditioning field. He pointed out that the fan or blower is the heart of any air handling system whether for heating, ventilating, air conditioning, or conveying materials.

The engineering committee of the association has carried on research for the purpose of checking all theories with actual practice. As a result of this care, there has been wide acceptance of the Standard Test Code for Fans by architects, engineers, engineering societies, governmental departments, such as the Navy, the Army, and Agriculture, as well as the recognition afforded by the Federal Trade Commission that the ratings of fans is a matter of public interest and therefore reasonable protection should be afforded the buyer against erroneous rating.

Bill to Aid Reversed Cycle Units Killed

DECATUR, ALA.—A resolution urging that the Tennessee Valley Authority begin experiments in reversed cycle heating units for homes was killed by a vote of eight to six at a meeting of the Southeastern Power Consumers Association here December 29. The association is composed largely of mayors of four southern states.

City Manager George Dempster of Knoxville led the opposition to the resolution contending that "authorities have practically proven this type of heating not feasible."

A.C. Conference at Wisconsin Announced

MADISON, WIS.—Announcement is made of a three-day Conference on Air Conditioning and Automatic Heat to be held at the University of Wisconsin on April 21, 22, and 23. The general plan is to devote three mornings to air conditioning and one afternoon each to stokers, oil burners, and gas heating.

It is planned that this conference take the place of the Conference on Solid Fuels and Domestic Stokers held here last year and which will hereafter be held in alternate years.

A feature of the conference will be exhibits brought here for display. Facilities will be provided at a nominal charge to permit a limited number of manufacturers and dealers to show their products. Thirty-three booths will be available for this purpose. An interesting program of live, discussion-provoking topics is being prepared under the direction of Prof. G. L. Larson, chairman, department of mechanical engineering.

Leonard Hill Receives Award

LONDON—The T. K. Sidey Summer Time Medal, which carries with it a prize of $500, has been awarded by the Royal Society of New Zealand to Sir Leonard Erskine Hill, British ventilation expert.

The award is made in memory of the late T. K. Sidey, who, after a quarter of a century's effort, secured the passage of the Daylight Saving Bill in New Zealand. The medal and prize is given for "the most valuable contribution to human knowledge by research in the study of light, visible and invisible, and other solar radiations in relation to human welfare." The previous award was made to Lord Rutherford, the physicist.

Sir Leonard Hill is director of research at St. John Clinic and Institute of Physical Medicine, London. He is the author of "Sunshine and Open Air," and has published a number of papers dealing with physiology and its relation to heating and ventilation.

Columbia A.C. Course

NEW YORK—Air conditioning will be the subject of a general course in the extension division of Columbia University during the Spring session. R. W. Waterfill, Buensod-Stacey Air Conditioning, Inc., will direct the work, which is designed to present fundamental principles of air conditioning and air conditioning systems, as well as the relation and functioning of the various units of a system.

Effort will be made to present the material to both the technically and non-technically trained student. The class will meet on Monday and Thursday evenings at 8:25 p.m.

Fuel Oil Sales Up 26.4% in '35

WASHINGTON—According to a recent report of the United States Bureau of Mines, sales of all grades of fuel oils for heating, exclusive of range oil, during 1935 amounted to 76,853,000 barrels, a gain of 26.4% over the 1934 total of 62,822,000 barrels.

The principal states in which this oil was sold, in order of their rank as consumers of heating oil, are (figures are in thousands of barrels):

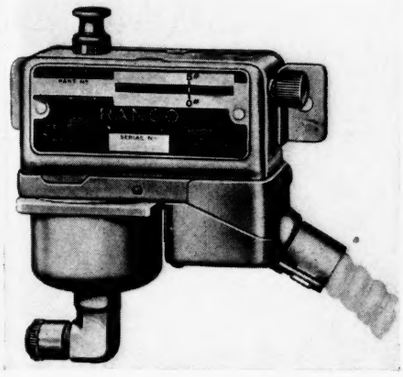
New York	16,213
Illinois	8,324
Massachusetts	7,760
New Jersey	6,192
Pennsylvania	5,354
California	3,566
Missouri	3,509
Connecticut	3,029
Minnesota	2,497
Michigan	2,384
Wisconsin	2,227
Rhode Island	1,447
Maryland	1,251
Washington	1,189
Indiana	1,103
District of Columbia	1,051
All other states	9,757
TOTAL	76,853

Frank H. Stevens

CAMDEN, N. J.—Frank H. Stevens, 53, assistant treasurer, general purchasing agent, and a director of Warren Webster & Co., Camden, N. J., died at his home in Collingswood, N. J., January 6, after an extended illness. Mr. Stevens entered the employ of Warren Webster & Co. as an office boy in 1898. He was active in civic and political affairs in Collingswood and had been a resident of the borough for 25 years. He is survived by his widow, two daughters, one grandchild, and a brother.

Mr. Stevens was vice-president of the board of school estimates of the Camden County Vocational Training School seven years, 10 years a member of the Collingswood Board of Education, five years a member of the Collingswood Sinking Fund Commission, from which he resigned on December 31 because of ill health; 27 years a member of F.&A.M., and president of the Twentieth Century Building and Loan Association, Camden. He was also a member of Cyrene Commandery, No. 7, Knights Templar; Excelsior Consistory, Valley of Camden, and Crescent Temple, Mystic Shrine. He was a member of the executive committees of the Camden City and Camden County YMCA. Mr. Stevens was treasurer of the Camden County Boys' Week program of the YMCA, and a leader in the Older Boys' Conference of New Jersey.

NEW EQUIPMENT



Ranco Pressure and Temperature Control

NAME AND MODEL NUMBER—Ranco type KO control.

PURPOSE—A standard steel corrosion-proof thermostat for general commercial use in pressure and temperature control.

FEATURES—Control is small and compact with an electrical rating of 3/4 hp., 110 to 220 volts, a.c., and 1/3 hp. and 115 volts d.c. Heavy contact pressures and large contact surfaces of silver together with the wide break which occurs when the overload trips or when the manual switch is operated, are said to result in a high rating. Temperature differential ranges from 4 to 20F, pressure differential from 4 to 30 lb. and with a high pressure differential of 30 lb. non-adjustable. Low pressure cutout has range of 20 to 40 lb., the high pressure 110 to 200 lb. For temperature cutout, ranges of from −15 to 20F; 0 to 35F, and 25 to 55F are available. The range calibration indicator is visible through a window of transparent material. Both range and differential are adjustable from the outside of the switch.

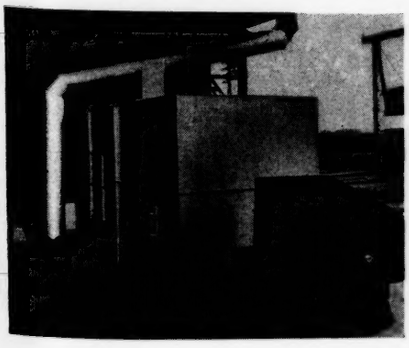
MADE BY—*Ranco, Inc., Columbus, Ohio.*

Smith Automatic Air Unit Heater

NAME—Smith automatic coal-fired air heater.

PURPOSE—For oven, process, or space heating.

FEATURES—Heater consists essentially of a combustion chamber to which coal is automatically fed by a stoker. Stoker is of the underfeed screw type with one motor driving both fan and worm screw. Motor is controlled by a thermostat in the warm air discharge. Combustion chamber is encased in heavy steel with the upper part of the walls and the top arch heavily insulated. The lower part of the walls is air cooled. The heat interchanger is built of heavy rectangular steel tubes and the gases flow through it on the counter flow principle. An automatic bypass damper is provided so that the flue gases can be bypassed around the heat interchanger if for any reason the fan handling the flue gases or the supply fan handling the air through the interchanger tubes stops.



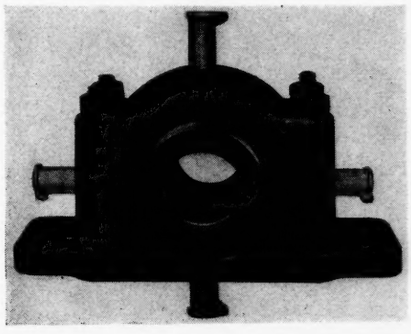
METHOD OF OPERATION—Flue gases from the combustion chamber pass through a heat interchanger and from there to a gas exhaust fan which forces the flue gases to a chimney. The air to be warmed is forced by a fresh air supply fan through the heat interchanger in an opposite direction to the flue gases. It is possible to have air leaving the heater at 700F. When the unit is used for drying or baking purposes and it is desired to have 700F air, the air makes four passes through the interchanger. If the unit is used for space heating or low temperature drying, the air makes but one pass through the interchanger.

MADE BY—*James Campbell Smith, Inc., 16374 Euclid Ave., Cleveland, Ohio.*

Randall Universal Pillow Block

NAME—Universal type double reservoir oil return pillow block.

PURPOSE—Oil return pillow block that can be mounted in any position according to the requirements of each individual installation.



FEATURES—To install, it is necessary only to select the mounting position needed, unscrew the oil cup, turn the ball to this position and reinsert the oil cup vertically. The pillow block has two large reservoirs in the spherical ball. A supply of oil is placed in the upper one which feeds the shaft as needed through graphite feed plugs and graphite pressure-packed channels. Oil recovery grooves divert unconsumed oil into the lower packed reservoir. The oil is again fed to the shaft and bearing through lower graphite feed plugs. The bearing is self-aligning and is precision bored.

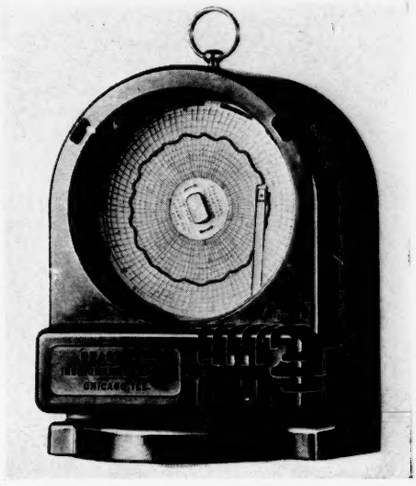
MADE BY—*Randall Graphite Products Corp., 609-613 W. Lake St., Chicago.*

Practical Recording Instruments

NAME—Practical recording instruments.

PURPOSE—To furnish reliable records in portable field use where delicate and expensive laboratory instruments should not be used. Obtainable to record air temperature and operation of electrical equipment.

FEATURES—All of this line of instruments is built with interchangeable parts. The case with all internal mechanism is identical in each instrument. Only the actuating element which controls the pen arm movement is different. The entire actuating mechanism and pen are built into the door so that they swing completely out of the way when the charts are being changed. Each instrument contains extra charts, a bottle of ink, and a blotter in the instrument case itself. The face of the instrument is non-breakable and the case of



black bakelite. Charts indicate 24-hr. operation.

TYPES AVAILABLE—Temperature measurement in one- and two-degree divisions. Equipment operation recorders in three types: one for devices drawing 100 to 400 watts, 110 to 220 volts; the second for any electrical device of 110 to 220 volts; and the third for any electrical device of 15 to 25 volts.

MADE BY—*Practical Instrument Co., 2717 North Ashland Ave., Chicago.*

Thrush Radiant Heat Control

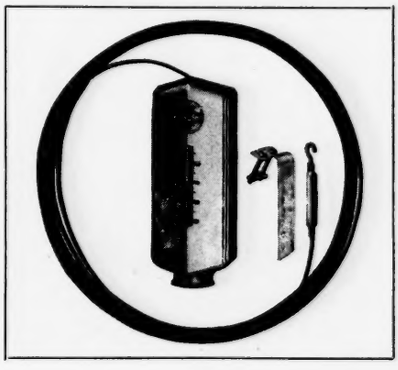
NAME—Thrush radiant heat control.

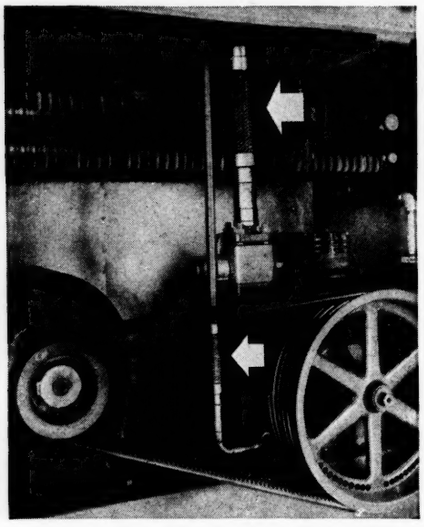
PURPOSE—For controlling the operation of hot water heating systems.

FEATURES—Radiant heat control is mounted on the wall of a typical room and a capillary tube leads from the control to a bulb attached to the return branch of the nearest radiator. The automatic firing device on the boiler, whether gas burner, oil burner, or stoker, is operated by an immersion type temperature control which maintains a constant supply of hot water in the boiler. When the room temperature varies even fractionally from that necessary to offset outside weather conditions, the radiator element will respond to a change of a few degrees in water temperatures. The control then turns on a hot water circulator and the water from the boiler is pumped into this system as soon as the radiant temperature has fallen very slightly. The manufacturer states that under such circumstances the temperature in the radiator system can be raised by the boiler full of hot water alone back to the comfort point at which time the radiant heat control stops the circulator.

LITERATURE AVAILABLE—Form No. RH-137.

MADE BY—*H. A. Thrush & Co., Peru, Ind.*





Chicago Pipe Vibration Absorbers

NAME AND MODEL NUMBER—Bronze vibration absorbers, RW-81.

PURPOSE—To prevent the transmission of vibration and noise from compressors into the building structure through the suction, discharge, or water lines of the compressor.

FEATURES—The flexible bronze used in these vibration absorbers is formed from strip metal into annular corrugations and welded. The absorbers are complete units with standard fittings which are attached to the compressor piping by brazing. Special fittings, elbows, or threaded couplings are also available.

LITERATURE AVAILABLE—Bulletin RW-4.

MADE BY—*Chicago Tubing & Braiding Co., Maywood, Ill.*

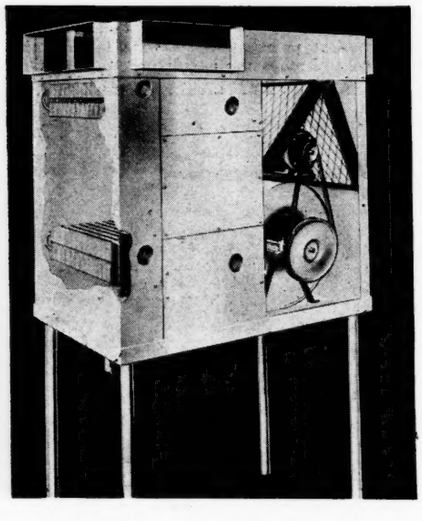
Waterfilm Universal Air Conditioner

NAME—Waterfilm Universal split air conditioner.

PURPOSE—For supplying humidified and cleaned air during the winter and cooled and cleaned air during the summer; for installation with either steam, vapor, or hot water heating systems.

FEATURES—Tempering coil, heated by hot water from boiler under waterline. During the winter this coil is always hot and will heat the air to 80F so that the fan can run continuously and never blow cold air. The humidifying system can be controlled manually or by a humidistat. A heating coil is also provided. With a steam system this heating coil is heated by steam and controlled by the burner. With a hot water system, the coil is controlled by a valve, pump and thermostat. During the summer the unit may be supplied with a complete mechanical cooling unit and cold water can be circulated through the heating and temperature coils.

MADE BY—*Waterfilm Boilers, Inc., 154 Ogden Ave., Jersey City, N. J.*



Electroaire Ozone Generator

NAME AND MODEL NUMBER — Electroaire ozone generator, JR.

PURPOSE—An ozone unit for attachment to the individual heating, ventilating, or air conditioning duct.

FEATURES—This unit can be attached to any air duct and thus ozonate the air going into a single room or section of the building. The unit is equipped with a rheostat and meter for regulating the ozone generator.

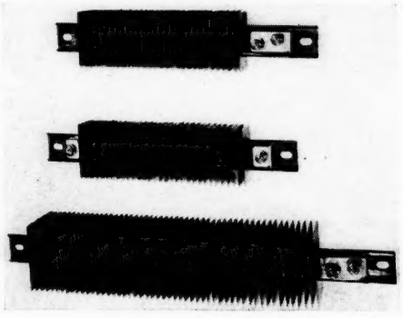
SIZE AND CAPACITIES—Three sizes with respective capacities of 3,000, 4,000, and 5,000 c.f.m.

MADE BY—*Electroaire Corp., 1455 West Congress St., Chicago, Ill.*

Trent Vane Type Electric Heater

NAME—Trent vane type electric heater.

PURPOSE—For heating air with electricity.



FEATURES—The unit is made up of an electrical heating strip with the addition of metal vanes which are welded to the flat tubular sheath of the unit. It was said that this construction results in a high rate of conduction of heat from the unit to the vanes and consequently rapid convection of heat. Heating unit casings are available in either steel, alloy of steel, or copper. Various terminal arrangements are available.

SIZES AVAILABLE—Eight standard lengths with variation of wattage and voltage to suit user's requirements.

MADE BY—*Harold E. Trent Co., 618-640 N. 54th St., Philadelphia, Pa.*

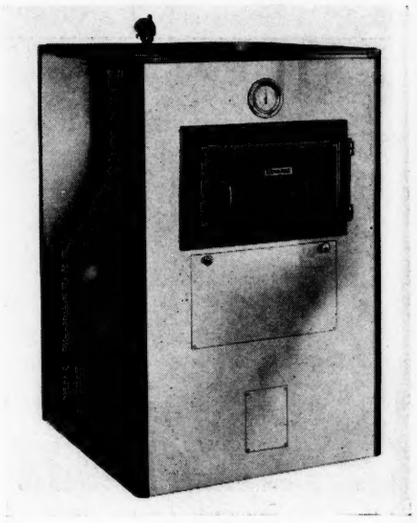
Fox Gas-Fired Air Conditioner

NAME AND MODEL NUMBER—Fox gas-fired air conditioner, series "M."

PURPOSE—Winter air conditioning.

FEATURES—Each steel heating element is made up of two sections which are welded together to make a seamless and leakproof unit. Each section is formed on a hydraulic press. The outer casing, of modern design, is finished in a green crystalline enamel with a contrasting trim of dark green. Manufacturer states that the price of the new product is substantially lower than that of the Sunbeam units with cast iron heating elements.

MADE BY—*The Fox Furnace Co., Elyria, Ohio.*



Kewanee Boiler Jackets

NAME—Kewanee Smartline jackets, types Rex, Square-Regal, and Regal.

PURPOSE—Jackets for covering Kewanee round "R" boilers.

FEATURES—Jackets are made of heavy metal and can be easily placed on after the piping has been connected and the boiler insulated. Jackets set on new steel base and have a crinkle finish in a pale green shade with contrasting dark tone corner moulds. The Smartline Rex is for front or rear fired assemblies, the Regal jackets being for complete enclosures of the boiler with any burner.

MADE BY—*Kewanee Boiler Corp., Kewanee, Ill.*

Ward Leonard Time Delay Relay

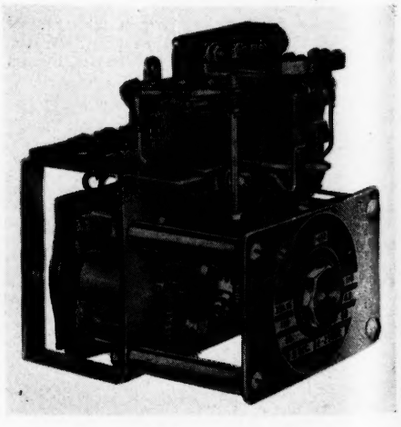
NAME—Ward Leonard motor-driven time delay relay.

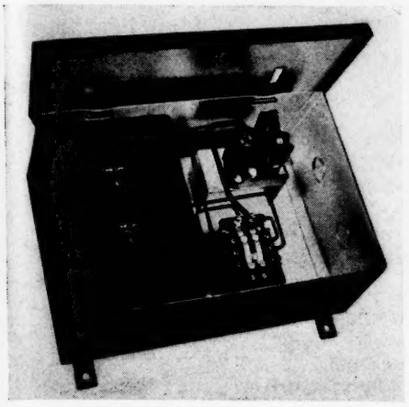
PURPOSE—To provide a definite time interval between two different operations. Time ranges from 35 sec. to 63 min. are possible.

FEATURES—The relay is designed for 60 cycle a.c. operation and consists of a small synchronous motor, a gear train, a pivoted tripping arm, and a magnetically operated brake. At the instant of tripping the contacts, a limit switch disconnects the motor. Differential gearing eliminates the use of clutches and the magnetically operated brake has been specially designed for the differential gear train.

LITERATURE AVAILABLE—Bulletin 362 gives complete description, contact data, dimensions, and prices.

MADE BY—*Ward Leonard Electric Co., Mount Vernon, N. Y.*





Spencer Stoker Timer

NAME—Klixon timer.

PURPOSE—For controlling the operation of stokers so as to maintain the fire.

FEATURES—The timer can be set to turn the heat on at intervals ranging from ½ to 1 hr. and can also be set to keep the heat on any length of time ranging from 2 min. to 7 min. These settings are entirely independent of each other. Another feature is a device for preventing the Timer from going on if the thermostat has been calling for heat and the fire has been built up. The Timer remains idle when the thermostat is functioning. Furthermore, the length of time that the Timer remains idle after the thermostat shuts off is automatically regulated in proportion to the length of time the thermostat has been calling for heat. If the thermostat has been calling for heat for a long period of time and the fire is built up to a high temperature, the Timer will remain idle longer than its set time to allow the fire sufficient time to cool down. If, on the other hand, the thermostat has been on for only a short time, the Timer's idle period is automatically shortened in order to eliminate all chances of the fire's going out. The manufacturer states that this unit is completely electric and has no clock mechanism or rotating parts. It is claimed that it can be used with practically any type of automatic stoker.

MADE BY—*Spencer Thermostat Co., Attleboro, Mass.*

Rochester Humidifier

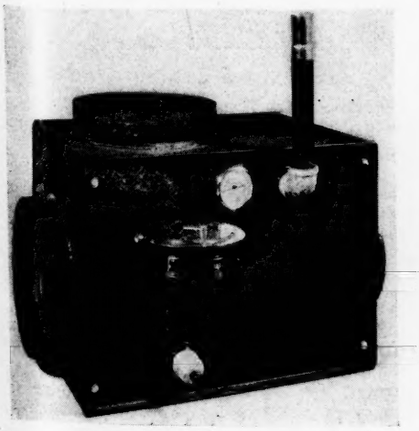
NAME AND MODEL NUMBER—Rochester humidifier, model HFW.

PURPOSE—For heating and adding humidity to residential buildings utilizing the waste heat in the flue gases.

FEATURES—The unit is designed to be attached at the back of the furnace or boiler ahead of the chimney pipe. Heat from the flue gases evaporates the water and superheated steam is delivered to the bonnet of the furnace. The manufacturer states that it is possible to evaporate up to 25 gal. water daily. Unit has a stainless steel evaporating unit with a heating surface of 1400 sq. in.

SIZES AVAILABLE—For 7-, 8-, 9-, and 10-inch stack sizes.

MADE BY—*Rochester Manufacturing Co., Inc., Brighton, Rochester, N. Y.*



Wilson Welding Electrode

NAME AND MODEL NUMBER—Wilson welding electrode, No. 520.

PURPOSE—Electrode for use with small transformer type a.c. arc welders.

FEATURES—Manufacturer claims that this welding rod makes it easy to strike and maintain an arc when utilizing a.c. current for welding. It is said to work equally well on d.c. machines.

MADE BY—*Wilson Welder & Metals Co., 60 E. 42nd St., New York.*

Peerless-Bellamy Conversion Burner

NAME—Peerless-Bellamy radiant gas burner.

PURPOSE—For converting boilers and furnaces to gas fuel.

FEATURES—Burner is said to produce a large amount of radiant heat. Burner head consists of a cast iron manifold with internal cast iron supports for a series of refractory

burner elements and is of such a size that it need not be taken apart for passing through firebox door when installing or removing. Refractory elements are fastened to the manifold with toggle bolts that can be easily removed. The manufacturer states that the flue gas temperature increases 60F every minute during the initial 5-min. operation. This is said to tend to eliminate condensation.

SIZES AND CAPACITIES—Available in five sizes with heat inputs of 90,000 to 300,000 B.t.u. per hr. for 3 in. of gas pressure.

MADE BY—*Peerless Manufacturing Corp., Louisville, Ky.*

Trane Packless Valve

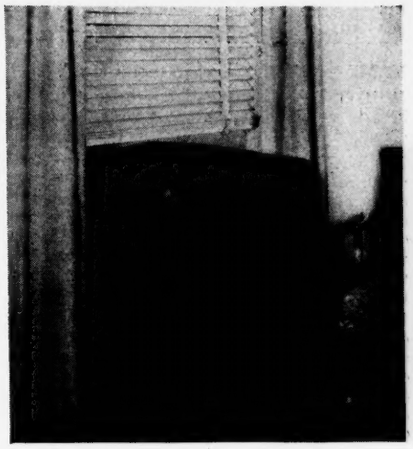
NAME—Trane hermetic radiator valve.

PURPOSE—A packless radiator valve without a bellows, designed for service on two-pipe vapor, vacuum, or steam heating system.

FEATURES—The valve proper receives its motion through a sealed diaphragm from a pressure button on the end of the valve stem. Movement of this diaphragm is said not to exceed 3/32 in. at any time. The operating mechanism of the valve utilizes multiplying levers to increase the travel of the diaphragm more than three times. The valve body is of cast brass with forged brass bonnets and collars.

TYPES AVAILABLE—Standard pattern with a wheel handle of bakelite. Other types available are key operated lock and shield pattern, lever handle or wheel and chain type for ceiling installations.

MADE BY—*Trane Co., La Crosse, Wis.*



Westinghouse Room Cooler

NAME—Window mounted room cooler.

PURPOSE—For cooling medium size offices and rooms.

FEATURES—Installation is very simple, it is only necessary to open the window of the room about half way, rest the unit on the sill, place the cabinet in position and plug the cord into the nearest wall socket. Other features are an hermetically-sealed condensing unit, compressor and motor cooled by refrigerant lines around the shell, air filters, and a ventilating damper for exhausting air from the room.

MADE BY—*Westinghouse Mfg. Co., E. Pittsburgh, Pa.*

Fedders Unit Heater

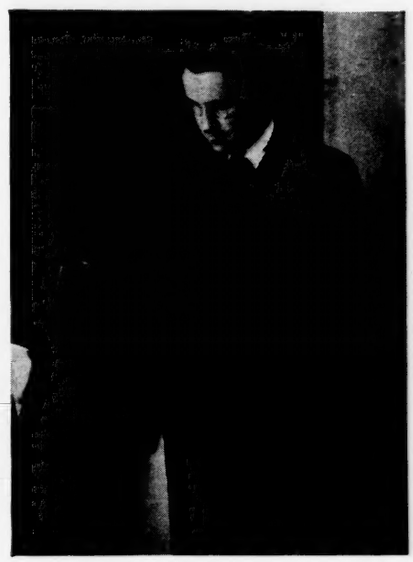
NAME AND MODEL NUMBER—Fedders unit heater, model 3023, series 3.

PURPOSE—A small size unit heater for small offices, gasoline stations, and other similar size installation.

FEATURES—Model follows the same design as the larger Fedders' models with the cabinet finished in a brown morocco-like texture. Element is mounted in cabinet by means of a full-floating mounting which is said to eliminate expansion stresses between the element and cabinet.

SIZES—75 sq. ft., e.d.r.

MADE BY—*Fedders Manufacturing Co., Inc., Buffalo, N. Y.*



Radiostat Temperature Control

NAME—Radiostat temperature control.

PURPOSE—For controlling the amount of heat to a building in accordance with outside conditions.

FEATURES—System consists of three temperature sensitive elements and a master electronic control. The temperature sensitive elements are sealed in a nickel steel case and consist of a non-corrosive electrical conductor wound on a special heat conducting base. The master control consists of two electronic tubes, resistors, and a motor starting relay.

METHOD OF OPERATION—The principle of operation of the system is that the resistance of an electrical conductor varies with a change of temperature. The regulating units of the system are coils of non-corrosive conductors encased and sealed against moisture. One of the units (C) is placed in the boiler water, another (F) on the return line, and a third (A) outside the building. When the outside air temperature decreases the resistance of the outside unit changes. This chance of resistance throws the circuits out of balance and an electronic tube in the master control (E) is called upon to restore this balance. In order to do that, more heat must be generated in the boiler, so the firing device is started. When the boiler sends steam through the system, eventually the return line is heated. The unit on the return line then restores the balance of the circuit.

On a winter morning the control is turned on at a predetermined time and the plant runs until the head of steam previously agreed upon is obtained. At this point, the plant will operate intermittently with a 1F boiler differential until the return starts heating, at which time the pressure will gradually drop as the demand for heat is diminished. The master control will automatically increase the temperature of the boiler water if either the outside temperature drops or the temperature of the return line decreases. If the return line temperature increases or the outside temperature increases the automatic control lowers the boiler water temperature so that less heat is sent to the building. When the outside temperature reaches 65F, no more steam is generated but the water is kept hot enough for supplying service hot water.

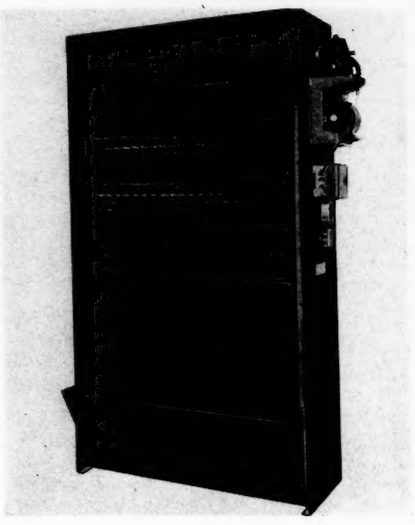
TYPES AVAILABLE—Applicable to steam, vacuum, or hot water heating systems.

MADE BY—*Radiostat, Inc., 1227 Washington Blvd., Chicago.*

Unimatic Air Filter

NAME—Unimatic air filter.

PURPOSE—A self-cleaning air filter for smaller than average air volumes where hand crank or pushbutton control is practical.

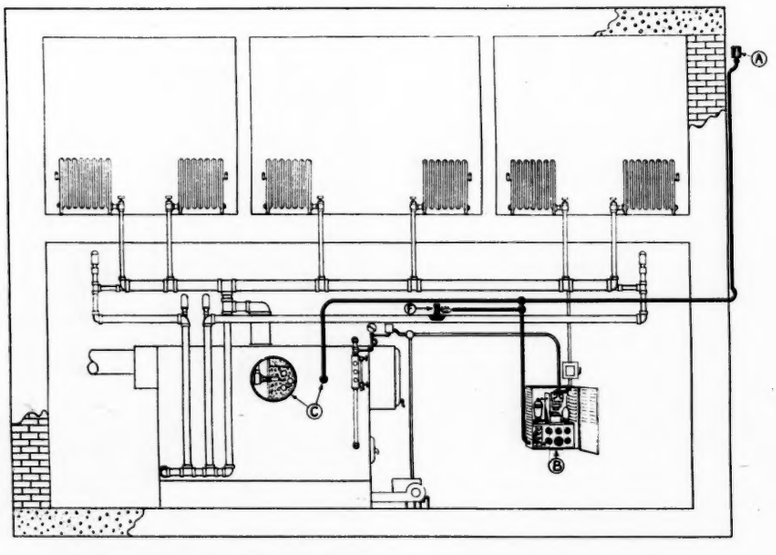


FEATURES—The Unimatic filter is a self-cleaning unit filter with a filter curtain made up of a number of standard units. There are two additional units to those required to make up the curtain. One is submerged in the reservoir being cleaned and the other draining at the back of the filter.

METHOD OF OPERATION—Operation consists of raising the clean, drained unit to the top of the curtain and lifting the submerged unit to the draining position. This permits the bottom unit in the curtain to slip down into cleaning position. This change is made once a week or once a day, or as frequently as required by the size of the filter and dust load, to maintain uniform operating conditions.

SIZES AVAILABLE—Capacities from 1,000 to 30,000 c.f.m.

MADE BY—*American Air Filter Co., Inc., Louisville, Ky.*



Radiostat temperature control operating one-pipe steam heating system.

Bodine Flange Mounting Base

NAME—Bodine flange mounting base.

PURPOSE—Flange mounting makes it possible to mount the motor either horizontally or vertically with the shaft perpendicular to the mounting surface.

FEATURES—The type N-1 frame with which the new mounting is used is normally rated at 1/50 hp. but lower ratings can also be furnished. This motor can be supplied with all types of windings regularly supplied on fractional horsepower motors. Flange mounting is adaptable to either ball or sleeve motors.

MADE BY—*Bodine Electric Co., 2264 W. Ohio St., Chicago.*

Condensation Engineering Heat Extractor

NAME—Howle heat extractor.

PURPOSE—For installation between gas-fired heating plants and the chimney to extract the heat from the flue gases and to eliminate condensation.

FEATURES—The unit is designed to remove the heat from the flue gases and radiate it into the basement. A water storage re-evaporator collects the condensate which forms when the gas burner first starts operation and re-evaporates the moisture as soon as the temperature in the heat extractor rises. A downdraft door automatically opens to release the back-draft and closes as soon as it subsides. Unit is constructed of enameling stock iron and finished with a special high temperature vitreous enamel.

MADE BY—*Condensation Engineering Corp., 333-35 S. Western Ave., Chicago.*

Burdett Gas Conversion Burner

NAME—Burdett radiant heat conversion burner.

PURPOSE—For converting boilers or furnaces to gas heating.

FEATURES—Gas is mixed with air and is taken by a pipe to the center of the burner head. The mixture is then deflected downward by a baffle, ignites and strikes the center of the disc. The heat scours down and outward to the edge of the refractory disc and the manufacturer claims that in less than 45 seconds a temperature approximating 2300F is obtained. A number of these burner heads are used and the conversion of each individual heating unit is accomplished by use of a custom-built manifold which permits the radiant heat from the burner heads to duplicate as nearly as possible a bed of glowing coals. The manifold is installed in relatively the same position as the grates which have been removed. All of the air for combustion is furnished by a blower which permits the installation of baffling to increase the heat absorption and lower the stack temperatures.

MADE BY—*Burdett Manufacturing Co., 19 N. Sheldon St., Chicago.*

Advanced Cooling Grids

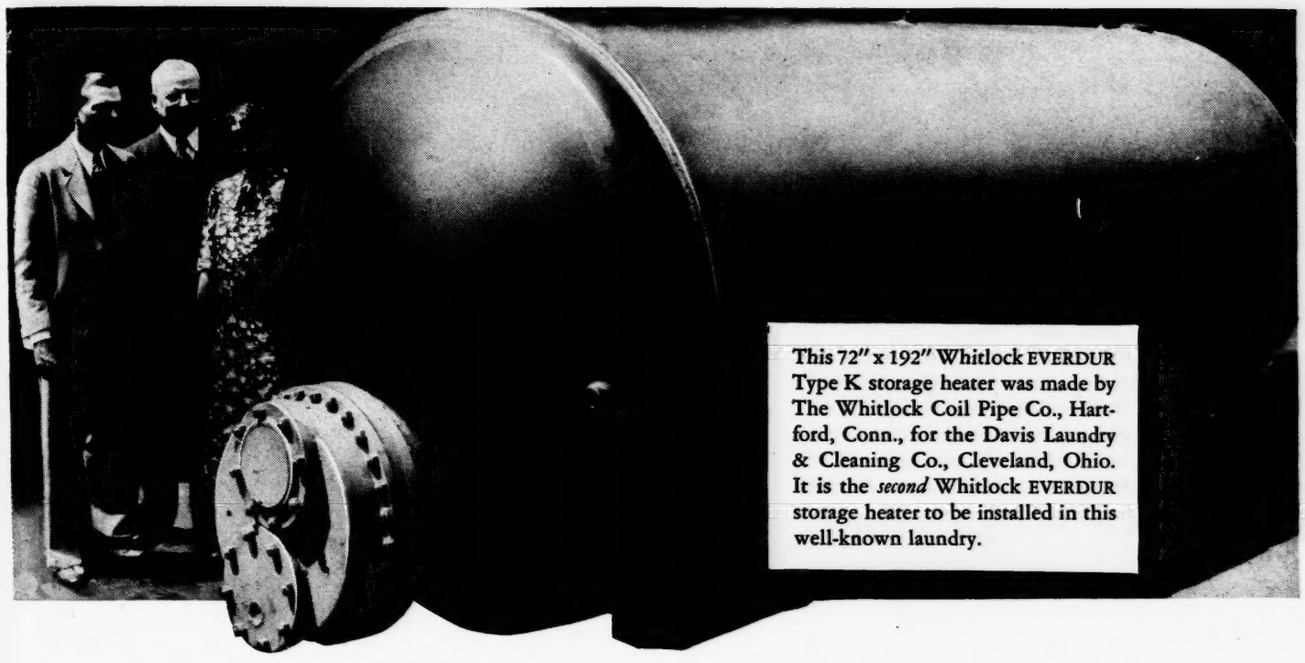
NAME—Hydro-Thermal refrigerating grids.

PURPOSE—For cooling air by means of direct expansion of refrigerants.

FEATURES—The manufacturer states that the grids are designed with scientific spacing of fins and balancing of the fin surface to the actual tube surface in direct contact with the refrigerant. They are said to collect only a thin layer of frost which evaporates back into the air during the shut down period of the machine.

SIZES—Made in three size fins, 8 x 8 in.; 6 x 6 in.; and 3½ x 6 in. Standard stock lengths.

MADE BY—*Advanced Refrigerating Systems Co., 33rd and Arch Sts., Philadelphia, Pa.*



This 72" x 192" Whitlock EVERDUR Type K storage heater was made by The Whitlock Coil Pipe Co., Hartford, Conn., for the Davis Laundry & Cleaning Co., Cleveland, Ohio. It is the *second* Whitlock EVERDUR storage heater to be installed in this well-known laundry.

Their business *depends* on clean water!

Laundry industry finds non-rust EVERDUR HEATERS *most economical*

The laundry industry is but one field where storage heaters of non-rust EVERDUR Metal have become widely accepted. Demand for them is found wherever clear, rust-free hot water and expense-free service are sought. Hospitals, textile mills, hotels, clubs, schools, government buildings... the evidence is overwhelming that this metal has proved itself the answer to the problem of heater corrosion. • EVERDUR is a rugged copper-silicon alloy possessing remarkable corrosion resistance; yet it has the strength and weldability of steel. It is made in all commercial shapes, including tank plates which conform to A. S. T. M. specification B96-36T. Let us send you additional data.

ANACONDA

A few of many other laundries that have adopted EVERDUR HEATERS

Lake Waban Laundry, Wellesley, Mass. • Lenox Laundry Co., Mt. Vernon, N.Y. • Home Laundry, Louisville, Ky. • Goodheart's Broadway Laundry Co., Denver, Colo. • Fauquier Laundry & Cleaning Co., Warrentown, Va. • Sutton Superior Laundry, New York City.

EVERDUR METAL—"Everdur" is a registered trade-mark identifying alloys made exclusively by The American Brass Company. 37163

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Final Degree-Day Figures for December, 1936

HEATING & VENTILATING continues its ninth year of publishing degree-day data for various large cities. The figures on this page are the final ones for December, 1936, while the preliminary figures for January, 1937, appear on page 76

	Albany, N. Y.	Atlanta, Ga.	Baltimore, Md.	Birmingham, Ala.	Boston, Mass.	Buffalo, N. Y.	Burlington, Vt.
Degree-days for December, 1936	1021	555	751	498	932	968	1219
Degree-days, Sept. 1, 1936 to Dec. 31, '36	2373	1099	1561	989	2161	2414	2981
Degree-days, Sept. 1, 1935 to Dec. 31, '35	2423	1308	1699	1195	2237	2569	3006
Degree-days, Sept. 1 to Dec. 31, Normal	2439	1131	1664	913	2130	2372	2772

	Cheyenne, Wyo.	Chicago, Ill.	Cincinnati, Ohio	Cleveland, Ohio	Columbus, Ohio	Denver, Colo.	Des Moines, Iowa
Degree-days for December, 1936	1068	964	846	888	872	887	1065
Degree-days, Sept. 1, 1936 to Dec. 31, '36	2803	2205	1927	2095	2031	2203	2379
Degree-days, Sept. 1, 1935 to Dec. 31, '35	2916	1339	2126	2259	2219	2262	2645
Degree-days, Sept. 1 to Dec. 31, Normal	2888	2225	1784	2185	2020	2276	2370

	Detroit, Mich.	Dodge City, Kan.	Duluth, Minn.	El Paso, Tex.	Erie, Pa.	Evansville, Ind.	Wort Wayne, Ind.
Degree-days for December, 1936	1012	842	1485	562	918	774	987
Degree-days, Sept. 1, 1936 to Dec. 31, '36	2432	1945	3746	1143	2190	1681	2288
Degree-days, Sept. 1, 1935 to Dec. 31, '35	2558	2003	3829	1025	2339	1861	2516
Degree-days, Sept. 1 to Dec. 31, Normal	2332	1952	3434	1038	2163	1545	2220

	Grand Rapids, Mich.	Harrisburg, Pa.	Hartford, Conn.	Indianapolis, Ind.	Kansas City, Mo.	La Crosse, Wis.	Lincoln, Neb.
Degree-days for December, 1936	1014	895	929	904	811	1203	1024
Degree-days, Sept. 1, 1936 to Dec. 31, '36	2457	1972	2184	2033	1812	2821	2213
Degree-days, Sept. 1, 1935 to Dec. 31, '35	2527	2033	2197	2268	2070	2964	2435
Degree-days, Sept. 1 to Dec. 31, Normal	2397	1981	2157	2002	1809	2778	2201

	Little Rock, Ark.	Los Angeles, Calif.	Louisville, Ky.	Madison, Wis.	Memphis, Tenn.	Milwaukee, Wis.	Minneapolis, Minn.
Degree-days for December, 1936	586	203	786	1168	582	1048	1316
Degree-days, Sept. 1, 1936 to Dec. 31, '36	1206	265	1740	2768	1233	2495	3031
Degree-days, Sept. 1, 1935 to Dec. 31, '35	1408	342	1896	2895	1437	2592	3227
Degree-days, Sept. 1 to Dec. 31, Normal	1079	424	1587	2756	1127	2601	2941

	Nashville, Tenn.	New Haven, Conn.	New Orleans, La.	New York, N. Y.	Norfolk, Va.	Oklahoma City, Okla.	Omaha, Neb.
Degree-days for December, 1936	658	897	290	795	584	644	1099
Degree-days, Sept. 1, 1936 to Dec. 31, '36	1407	2050	480	1783	1128	1447	2391
Degree-days, Sept. 1, 1935 to Dec. 31, '35	1597	2108	622	1883	1304	1589	2580
Degree-days, Sept. 1 to Dec. 31, Normal	1363	2109	403	1849	1195	1379	2284

	Peoria, Ill.	Philadelphia, Pa.	Pittsburgh, Pa.	Portland, Me.	Portland, Oreg.	Providence, R. I.	Reading, Pa.
Degree-days for December, 1936	967	788	815	1061	658	908	818
Degree-days, Sept. 1, 1936 to Dec. 31, '36	2191	1692	1894	2571	1540	2133	1862
Degree-days, Sept. 1, 1935 to Dec. 31, '35	2528	1768	2083	2584	1782	2190	1975
Degree-days, Sept. 1 to Dec. 31, Normal	2323	1735	1949	2496	1724	2129	2014

	Richmond, Va.	Rochester, N. Y.	St. Louis, Mo.	Salt Lake City, Utah	San Francisco, Calif.	Scranton, Pa.	Seattle, Wash.
Degree-days for December, 1936	730	951	793	936	417	946	652
Degree-days, Sept. 1, 1936 to Dec. 31, '36	1429	2362	1702	2192	842	2251	1664
Degree-days, Sept. 1, 1935 to Dec. 31, '35	1589	2517	2000	2268	971	2404	1777
Degree-days, Sept. 1 to Dec. 31, Normal	1406	2414	1738	2149	949	2274	1881

	Spokane, Wash.	Syracuse, N. Y.	Toledo, Ohio	Trenton, N. J.	Utica, N. Y.	Washington, D. C.	Wichita, Kan.
Degree-days for December, 1936	994	987	972	842	1067	779	779
Degree-days, Sept. 1, 1936 to Dec. 31, '36	2560	2357	2286	1892	2492	1616	1734
Degree-days, Sept. 1, 1935 to Dec. 31, '35	2660	2550	2476	1988	2714	1737	1946
Degree-days, Sept. 1 to Dec. 31, Normal	2583	2491	2189	1760	2537	1741	1783

To obtain unit fuel consumption figures for any city shown above, multiply the number of degree-days by the following factors: for coal, 0.008; for oil, 0.00069; for gas, 0.096. Figures obtained will show coal consumption in pounds per square foot of radiator surface; oil consumption in gallons per square foot; gas consumption in cubic feet per square foot—all for the period covered by the number of degree-days. The figures assume the use of steam radiators emitting 240 B.t.u. per sq. ft. per hr., a system operation at 100% efficiency, and radiators calculated for maintaining 70° in zero weather. Heating values assumed for the fuels are 12,000 B.t.u. per lb. for coal; 140,000 B.t.u. per gal. for oil, and 1,000 B.t.u. per cu. ft. for gas. To correct for other heating values, efficiency and design conditions, follow the method explained in the "HEATING & VENTILATING Degree-day Handbook" or on H. & V.'s Reference Data Sheet Nos. 67 and 68. Degree-days as given above for a "normal" month or season are based on averages for a long period of years, ending about 1922. Averages covering different periods will disagree with the above figures slightly.

FEDDERS *All Season*
AIR CONDITIONING UNITS

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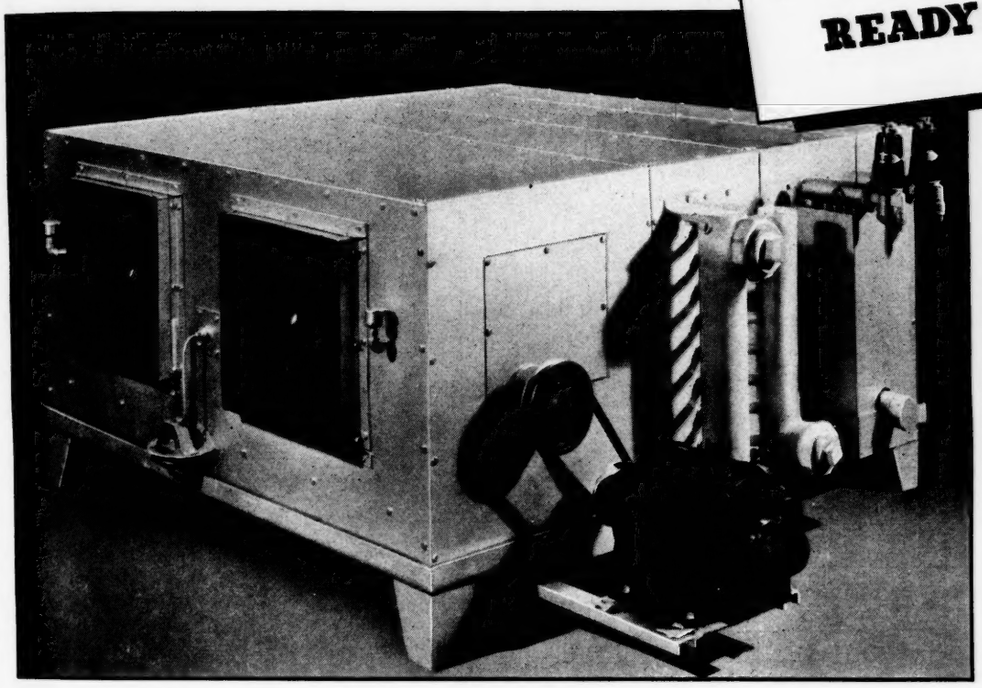
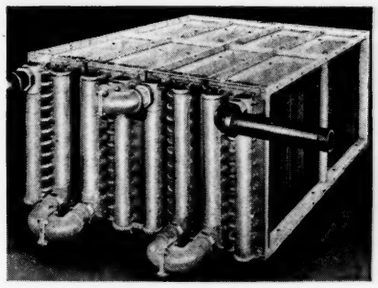
READY TO INSTALL



Product of **FEDDERS**
41 Years of Heat Transfer Experience



The Complete Line of Unit Conditioners for Any Combination of Air Filtering, Cooling, Dehumidifying, Heating and Humidifying

Designed FOR Air Conditioning Engineers BY Air Conditioning Engineers, Fedders ALL SEASON Conditioning Units are being welcomed by every man responsible for engineering, installation, operation and maintenance of the system.

Forty-one years of specialized experience in designing and building heat transfer equipment is responsible for these features—

1. Lighter weight per capacity for easier handling and installation.
2. Less space required per capacity, thus simplifying layout of system.
3. Air filters, cooling and heating coils, humidifiers and blowers balanced in capacity and performance to assure maximum efficiency with minimum field engineering.
4. Fedders high efficiency ALL COPPER cooling and heating coils designed for correct distribution of refrigerant, cold water, steam or hot water.
5. Compact manifolding minimizes space requirements.
6. Fedders High Capacity Thermostatic Expansion Valves accessibly located on exterior for easy adjustment.
7. Complete accessibility to entire interior of cabinet through removable panels gives quick access to filters, coils, humidifiers and blowers.
8. Interchangeable parts for suspended or floor installations.
9. Rustproofed construction throughout.
10. Light, rigid frame reinforces entire unit . . . maintains alignment . . . permits shipment in any position.

Fedders Coils Cataloged on a Package Basis

Complete lines of Fedders Coils are built for use with refrigerant, cold water, steam or hot water. Copper fins and copper tubes assure highest heat transfer efficiency. Coils are correctly manifolded to assure correct distribution throughout each section of the coil in accordance with varying temperature differentials set-up as air progresses through coils. Write for Bulletins giving ratings and specifications.

Fedders All Season Conditioning Units are built in a complete line of capacities ready for connecting to condensing unit, well water, steam or hot water supply. They are available for complete cooling, heating, humidifying and filtering or for summer cooling, dehumidifying, and filtering only.

Write for complete information and data—the coupon is for your convenience.

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NEW YORK—114 E. 16th Street
PHILADELPHIA—2100 Arch Street

FEDDERS MFG. CO.
Buffalo, N. Y.

Please send complete data on Fedders Unit Conditioners and Coils.

Name .....
Concern .....
Street .....
City .....

HV-2

Rochester Public Library
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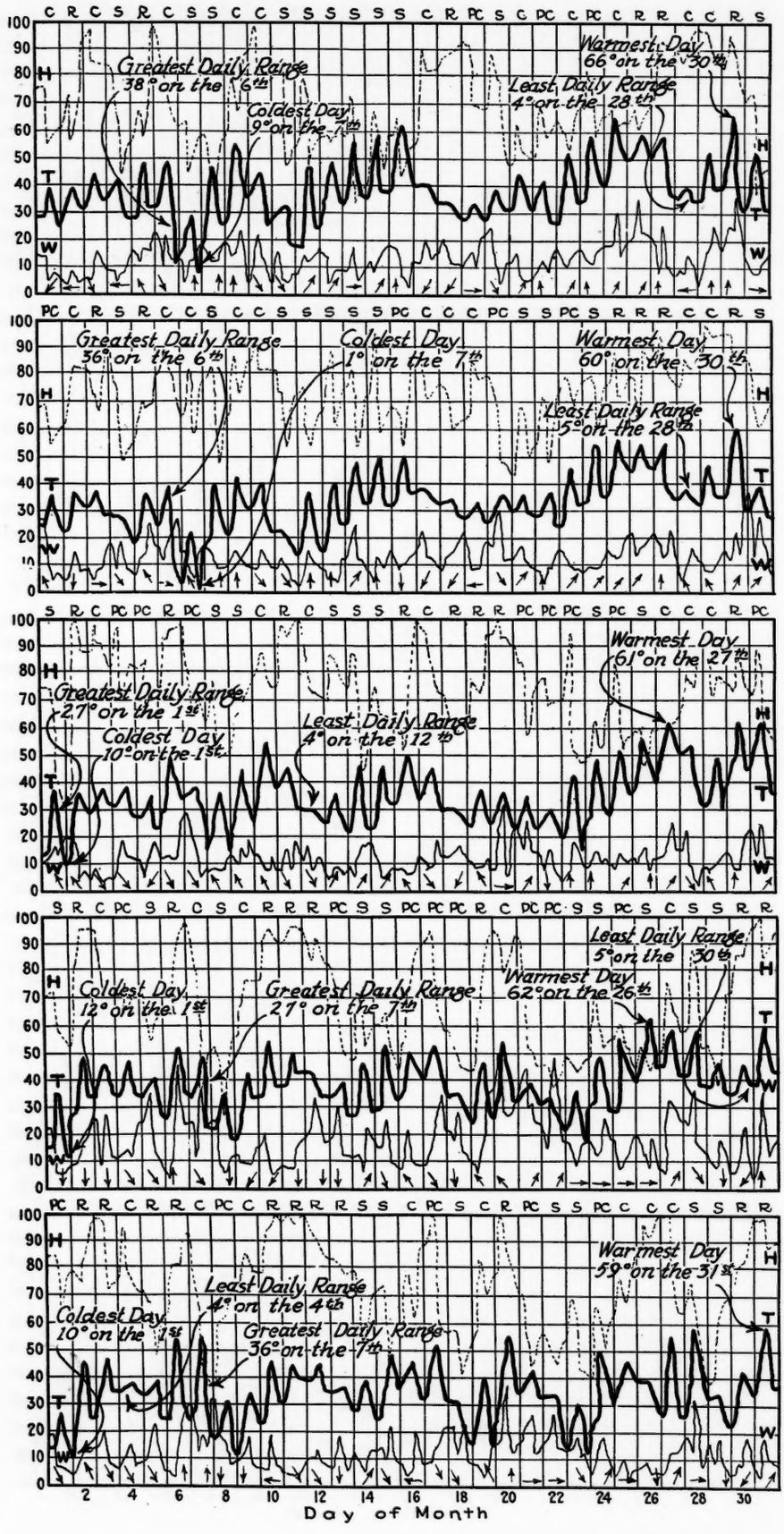
THE WEATHER FOR DECEMBER, 1936

Plotted from records compiled for HEATING & VENTILATING by the U. S. Weather Bureau. Heavy curves (T), dry bulb temperatures in deg. F.; dotted lines (H), per cent relative humidity from readings at 8 a.m., noon, and 8 p.m. Light lines (W), wind velocity in m.p.h. Arrows indicate prevailing wind directions, north being arrow pointing up, etc.; S—clear; PC—partly cloudy; C—cloudy; R—rain; Sn—snow.


Greatest Daily Range 38° on the 6th
Coldest Day 9° on the 7th
Warmest Day 66° on the 30th
Least Daily Range 4° on the 28th
Greatest Daily Range 36° on the 6th
Coldest Day 1° on the 7th
Warmest Day 60° on the 30th
Least Daily Range 5° on the 28th
Greatest Daily Range 27° on the 1st
Coldest Day 10° on the 1st
Least Daily Range 4° on the 12th
Warmest Day 61° on the 27th
Coldest Day 12° on the 1st
Greatest Daily Range 27° on the 7th
Least Daily Range 5° on the 30th
Warmest Day 62° on the 26th
Least Daily Range 4° on the 4th
Coldest Day 10° on the 1st
Greatest Daily Range 36° on the 7th
Warmest Day 59° on the 31st
Day of Month

St. Louis

Mean temp. for month, 39.4F; aver. wind velocity, 12.2 m.p.h.; prevailing direction of wind, S.

Chicago

Mean temp. for month, 34.0F; aver. wind velocity, 11.3 m.p.h.; prevailing direction of wind, SW.

Pittsburgh

Mean temp. for month, 35.8F; aver. wind velocity, 11.0 m.p.h.; prevailing direction of wind, S.

New York

Mean temp. for month, 39.2F; aver. wind velocity, 15.6 m.p.h.; prevailing direction of wind, N.

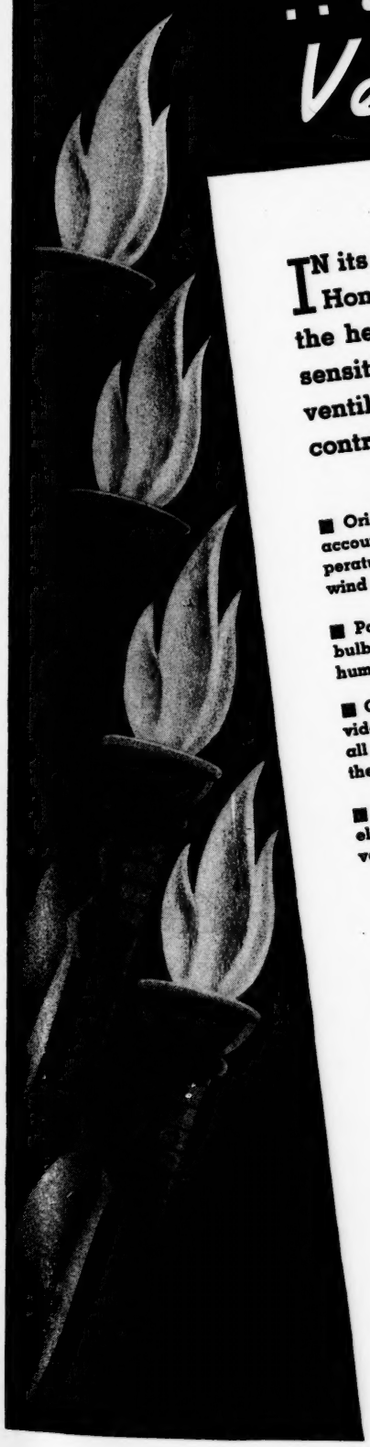
Boston

Mean temp. for month, 35F; aver. wind velocity, 11.0 m.p.h.; prevailing direction of wind, NW.

MINNEAPOLIS-HONEYWELL

CONTRIBUTIONS

.. to the Heating and Ventilating Industry



IN its fifty-two years of Automatic Control leadership Minneapolis-Honeywell has made a number of noteworthy contributions to the heating and ventilating industry, making possible much more sensitive and accurate automatic control for all types of heating, ventilating and air conditioning systems. Among the important contributions, Minneapolis-Honeywell has:

■ Originated outside control which takes into account all weather factors including temperature, solar radiation, wind direction and wind velocity.

■ Popularized compensated control for dry bulb temperature in summer and for proper humidity in winter.

■ Originated the Series 10 Circuit, which provides safe operation of automatic firing under all conditions and makes possible the use of the heat acceleration principle.

■ Originated true modulation — accomplished electrically, permitting precise positioning of valves or louvers.

■ Originated control of multiple stage cooling with either several compressors cut in and out or with a series of solenoid valves.

■ Originated the heat acceleration principle of thermostatic control which eliminates Cold 70° and provides even temperature at all times without manual adjustment.

■ Popularized economizer control which utilizes outdoor air for either heating or cooling whenever possible.

■ Popularized automatic change-over in heating and cooling cycles as changes in outside conditions demand.

In addition Minneapolis-Honeywell has provided educational material for use in schools, text books and for the industry at large. A complete practical laboratory has been established in the form of an Air Conditioning system in its general offices which permits use of all types of air conditioning equipment. These and other developments contribute to the increasing popularity and sale of air conditioning by insuring consumer satisfaction. Minneapolis-Honeywell Regulator Co., 2715 Fourth Avenue So., Minneapolis, Minn. Branch and distributing offices everywhere.

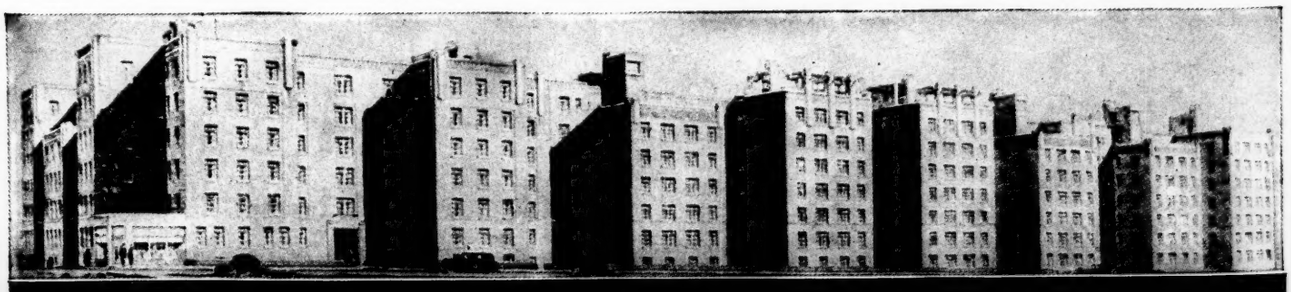
MINNEAPOLIS-HONEYWELL
CONTROL SYSTEMS

AUTOMATIC CONTROLS MH

Preliminary Degree-Day Figures for January, 1937

The table below gives degree-day figures for January for 48 important cities. These figures are preliminary, based on wired reports, and will be followed in next month's issue by final figures. Final figures for December, 1936, appear on page 72

Albany, N. Y.	973	Little Rock, Ark.	681
Atlanta, Ga.	356	Los Angeles, Calif.	516
Baltimore, Md.	643	Memphis, Tenn.	609
Birmingham, Ala.	269	Milwaukee, Wis.	1276
Boston, Mass.	838	Minneapolis, Minn.	1790
Buffalo, N. Y.	987	Nashville, Tenn.	535
Cheyenne, Wyo.	1563	New Haven, Conn.	842
Chicago, Ill.	1186	New Orleans, La.	81
Cincinnati, Ohio	809	New York, N. Y.	732
Cleveland, Ohio	901	Oklahoma City, Okla.	1018
Columbus, Ohio	820	Omaha, Neb.	1629
Denver, Colo.	1405	Philadelphia, Pa.	715
Des Moines, Iowa	1533	Pittsburgh, Pa.	801
Detroit, Mich.	1051	Portland, Me.	1007
Dodge City, Kan.	1335	Portland, Oreg.	1064
Duluth, Minn.	1889	Richmond, Va.	546
El Paso, Tex.	666	St. Louis, Mo.	1031
Erie, Pa.	914	Salt Lake City, Utah	1574
Evansville, Ind.	802	San Francisco, Calif.	645
Fort Wayne, Ind.	1053	Scranton, Pa.	905
Grand Rapids, Mich.	1130	Seattle, Wash.	1000
Harrisburg, Pa.	844	Spokane, Wash.	1659
Indianapolis, Ind.	956	Washington, D. C.	639
Kansas City, Mo.	1264	Wichita, Kan.	1224



Another Row of Sarco Heated Apartment Buildings

Back in 1932 the first Sarco Heating System was installed in one unit of this splendid apartment development at Woodside, Long Island.

Four years later, four additional units were Sarco equipped, in accordance with outright specifications by Springsteen & Goldhammer, well known architects.

The conclusion is obvious.

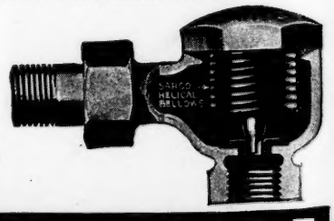
Sarco heating specialties are dependable. They guarantee efficient, noiseless and adequate heat in buildings of all types and sizes. You can specify and use them with confidence.

Details will be found in Catalog P-45. Write for it.

SARCO CO., INC., 183 Madison Ave., New York, N. Y.

Branches in Principal Cities

SARCO CANADA LIMITED, Federal Bldg., Toronto, Ont., Canada



SARCO HEATING SYSTEM

COMING EVENTS

MARCH 15-19, 1937. NATIONAL OIL BURNER AND AIR CONDITIONING EXPOSITION, *Commercial Museum, Philadelphia. Sponsored by the Oil Burner Institute, New York.*

APRIL 21-23, 1937. THREE-DAY CONFERENCE ON AIR CONDITIONING AND AUTOMATIC HEAT, *University of Wisconsin. Madison, Wis.*

MAY 17-21, 1937. 48TH ANNUAL CONVENTION OF THE HEATING, PIPING AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION, *Hotel Nicollet, Minneapolis, Minn.*

MAY 24-27, 1937. 55TH ANNUAL CONVENTION OF THE NATIONAL ASSOCIATION OF MASTER PLUMBERS, *Atlantic City, N. J. Convention headquarters at the Ambassador Hotel. In connection with the convention, The 1937 Home Comfort Exposition will be held in the Atlantic City Auditorium.*

MAY 25-27, 1937. SPRING MEETING OF THE AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, *French Lick Springs, Ind.*

MAY 25-27, 1937. 4TH SHORT COURSE IN COAL UTILIZATION, *University of Illinois, Urbana, Ill.*

MAY 25-28, 1937. ANNUAL CONVENTION OF THE NATIONAL DISTRICT HEATING ASSOCIATION, *Detroit, Mich.*

JUNE 23-26, 1937. SEMI-ANNUAL MEETING OF THE AMERICAN SOCIETY OF HEATING & VENTILATING ENGINEERS, *New Ocean Hotel, Swampscott, Mass.*

JUNE 1937. 31ST ANNUAL CONVENTION OF THE SMOKE PREVENTION ASSOCIATION, INC., *New York.*

AUGUST 3-7, 1937. POWER SHOW AND MECHANICAL EXPOSITION, *The Universal Craftsmen Council of Engineers of the World, Hotel Stevens, Chicago, Ill.*

OCTOBER 5-8, 1937. 66TH ANNUAL MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION, *New York City.*

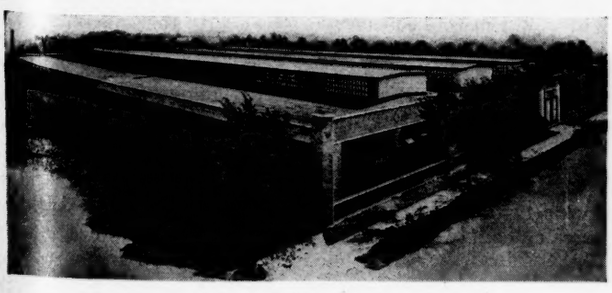
WITH THE MANUFACTURERS

Alco Valve Co., Inc., St. Louis, has moved its Chicago district office and warehouse to **707 Merchandise Mart.**

Anthracite Industries, Inc., New York, N. Y., in order to further extend its cooperative work with manufacturers of anthracite burning equipment, assumed direction of the Laboratory at Primos, Pa., as of December 1, 1936. The work which has been done in the laboratory under the direction of Anthracite Institute will be extended and expanded along lines of assisting manufacturers in improving present equipment and in bringing out new equipment. **Allen Johnson** continues as director of the laboratory.

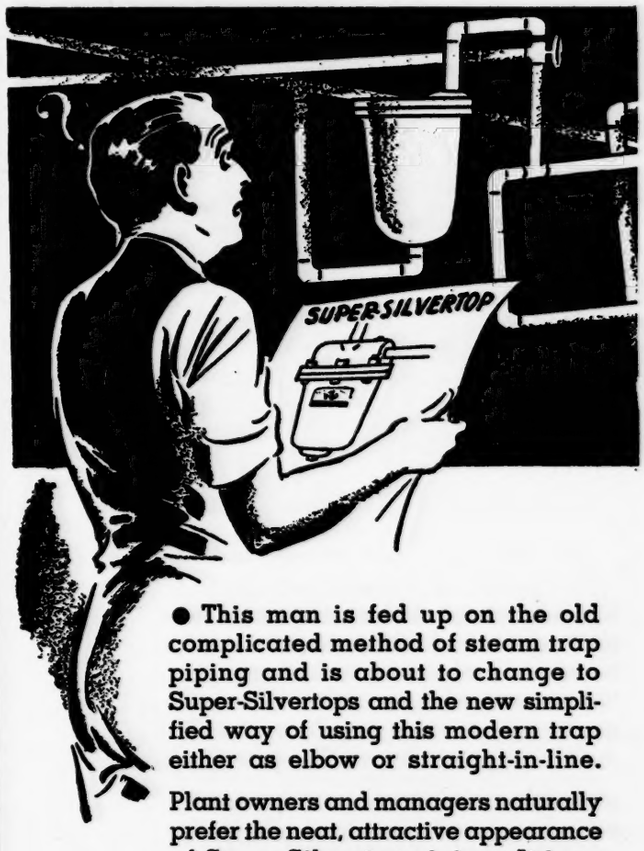
James P. Duffy was appointed assistant to the president in charge of advertising and merchandising activities. Mr. Duffy for the past seven years was advertising manager of The Delaware, Lackawanna & Western Coal Co.

Automatic Products Co., Milwaukee, Wis., announces that **Roy W. Johnson,** president, has purchased the newly built plant of the Fuller-Warren Stove Co., with 60,000 sq. ft. of floor space. According to **Earl Vallee,** sales manager, one of the advantages of the new building is that all of the production will be on one floor. The plant is located at **2450 North 32nd St.**



Automatic Products Company's new plant.

Portrait of a Man About to change to SUPER-SILVERTOP



● This man is fed up on the old complicated method of steam trap piping and is about to change to Super-Silvertops and the new simplified way of using this modern trap either as elbow or straight-in-line.

Plant owners and managers naturally prefer the neat, attractive appearance of Super-Silvertop piping. It is so clean cut, so sensible and saves so much installation time—as much as 60 minutes per trap. Then too, Super-Silvertops do not leak steam, hence they work on vacuum as well as on pressure. Traps that are not recommended for use on vacuum definitely leak steam.

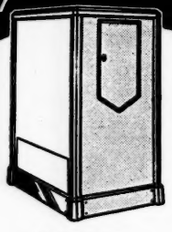
Super-Silvertops are easy to inspect or clean—it is not necessary to remove the trap from the line. In addition, Super-Silvertops have much more capacity, averaging 76% more than all other traps. Write today for complete information and prices.

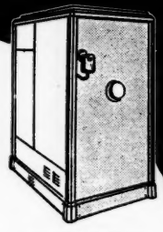
THE V. D. ANDERSON CO.
1943 West 96th St. • Cleveland, Ohio

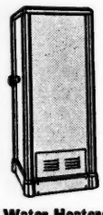
THE *Only* COMPLETE STEAM TRAP

SCOTT
S-N
NEWCOMB
Complete Line
AUTOMATIC HEATING
and
AIR CONDITIONING
Equipment

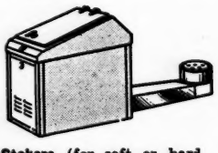
Oil Burners (8 sizes)

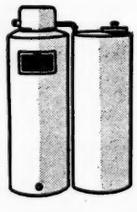

Boilers, Cast Iron, Steel (Oil, Gas, Stoker)


Air Conditioners (Oil, Gas, Stoker)


Water Heaters (Oil, Gas, Stoker)

Room Coolers and Central Cooling


Stokers (for soft or hard coal) (5 sizes)


Water Softeners (All sizes)

Basement Sprinkler Systems (A popular novelty that gets you into prospects' homes)

S-N Dealers Prosper
because

1 There's a S-N product for every month in the year.

2 "S-N" means highest quality —at competitive prices.

3 The industry recognizes S-N as pioneers and authorities in the field.

4 A complete line of easy-to-sell accessories "opens up leads" for major equipment.

Illustrated broadside describes S-N products in detail. Send for it—no obligations.

SCOTT-NEWCOMB, INC.
1924 Pine St. St. Louis, Missouri

Autovent Fan & Blower Co., Chicago, has made the following promotions and appointments: **Tom Brown** has been made vice-president and general manager, while **George J. Kalwitz** has been promoted from sales engineer to general sales manager. **Robert F. Ruggles**, formerly manager of the New York office, has been named eastern division manager. New representatives appointed are: **Frank B. Nimmo**, Minneapolis; **R. J. Engel**, Appleton, Wis.; **B. J. Doyle**, Milwaukee, Wis.; **Industrial Representatives**, Peoria, Ill.; **Allan T. Shepherd**, Richmond, Va.; **Engineering Sales & Service Corp.**, Louisville, Ky.; **Harold M. Hudson**, Seattle, Wash.

Bastian-Morley Co., Inc., LaPorte, Ind., has promoted **Jim Donnelly** to the position of sales manager. Mr. Donnelly, formerly sales promotion manager, joined Bastian-Morley in 1923 and in 1926 became advertising manager. In 1928 he was made sales promotion manager. In his new position Mr. Donnelly retains the supervision of advertising and sales promotion.

J. P. Hutchinson has been promoted to assistant sales manager. He joined the company's sales staff at Minneapolis in January, 1929, and was transferred to the general office sales department later that year where he has specialized in gas boiler sales as well as assisted in general sales and sales promotion.

R. I. Smith, formerly sales representative in Philadelphia, has been transferred to the factory in the position of manager of the testing and inspection department.

Berger Mfg. Co., Canton, Ohio, subsidiary of Republic Steel Corp., has appointed **R. I. Schuppener** general sales manager of its new building products divisions. For the past 10 years Mr. Schuppener was department sales manager of the Wheeling Corrugating Co., Wheeling, W. Va.

Borg Warner Service Parts Co., 310 S. Michigan Ave., Chicago, has distributed 25,000 copies of its new 88-page automatic heating and air conditioning catalog to dealers, contractors, and service organizations, according to **Ray P. Johnson**, manager of the refrigeration and automatic heating department. Western Union messengers distributed catalogs in 47 cities while other communities were served by mail. This company, according to Mr. Johnson, renders a definite service to the heating and air conditioning industry by being able to supply the products of reputable manufacturers from stocks located in a number of cities.

Century Engineering Corp., Cedar Rapids, Iowa, entertained a number of its eastern distributors and dealers at its main offices recently. Among the visitors were: Messrs. **Kelley** and **Beckley**, Century Products Co. of New York; Messrs. **McCoubrey** and **Sykes**, Clifco Heat and Appliance Co., Boston; **C. A. Leander**, Worcester, Mass.; Messrs. **Eberly** and **Scott**, Philadelphia.

The Combustioneer Div., Steel Products Engineering Co., Springfield, Ohio, has announced the creation of a domestic stoker sales division of which **H. W. Prior** has been appointed sales manager. Mr. Prior has had years of experience in specialty selling, having been sales manager of the Delco Light Co. and the Frigidaire Corp. The commercial and industrial division will be handled by **Walter S. Burke** who has been with Combustioneer since its inception.

Crane Co., Chicago, has appointed **J. I. Robinson** vice-president of Crane Ltd., Canada, succeeding **J. Austin Murphy** who retired after 51 years with the company. Mr. Robinson joined the Crane San Francisco branch in 1907, and in 1919 was transferred to Montreal where he later held the position of director and general manager.

Cutler-Hammer, Inc., Milwaukee, Wis., has appointed **T. D. Montgomery** manager of its foreign sales division.

C. A. Dunham Co., Chicago, has appointed **C. B. Antill**, formerly of its Chicago office, manager of the New York sales office, 1840 RCA Building, 30 Rockefeller Plaza. **Lewis Smith**, manager of the eastern division sales office, who temporarily operated the New York office, will continue to maintain the divisional sales office at the same address.

Sturtevant

REG. U. S. PAT. OFF.

Puts Air to Work

This giant fan—22 feet wide and over 16 feet high, handles 5½ tons of air per minute—recently shipped for industrial air conditioning work in South America.

FANS from Largest to Smallest . . . and Everything Between

You can get blowers or exhausters of every type . . . large or small . . . to meet any need . . . from Sturtevant. Whether it's Ventilating Fans or Air Conditioning Fans. Acid Resisting Fans . . . high pressure blowers . . . mechanical draft fans, forced or induced.

For air handling and conditioning equipment of practically every kind, Sturtevant is the logical source. The equipment at the right is merely representative of the complete line.

Let us cooperate in solving your air handling problems. Our 75 years experience is at your service.

B. F. STURTEVANT COMPANY HYDE PARK, BOSTON, MASS.

Sales Offices in 40 Cities . . . B. F. Sturtevant Co. of Canada—Galt, Toronto, Montreal

Blowers . . . Exhausters

Centrifugal and propeller types. For ventilating, fume removal, and all other purposes. Acid Resisting Fans. High Pressure Blowers.

Air Washers

Made in several types and wide range of capacities to meet varying requirements in cleaning, cooling, dehumidifying, and humidifying air.

Vacuum Cleaners

Used for removing dangerous dust and for general cleaning purposes. Assure speedy, thorough cleaning and effective disposal of dust and dirt. Portable types and central systems.

Air Conditioning

Individual units of equipment or complete central systems for maintenance of desired temperature and humidity in industrial air conditioning.

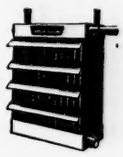
Draft Equipment

Forced and Induced Draft Fans; Air Preheaters; Water Economizers; Steam Turbines; Reduction Gears. Complete units . . . undivided responsibility.

Power Roof Ventilators

Electric motor driven. Equipped with a powerful, efficient fan wheel which does a real ventilating job. Can be built of acid-resisting metals if necessary.

Unit Heaters



In types for ceiling, wall, or floor installation. Widest and most varied range of capacities available up to 1,500,000 B.T.U.

Electric Motors

AC and DC. Fraction and integral horsepower sizes. For general purposes and special applications.

WORLD'S LARGEST MAKER OF AIR HANDLING AND CONDITIONING EQUIPMENT

Guaranteed Against Rust and Red Water....

Rust is a merciless, persistent fighter. It quickly eats holes in ordinary heaters. It causes red water, which stains sinks and bathtubs and also stains clothes in the laundry.

Why risk injuring your reputation and losing business by installing a heater that causes rust and red water? You take no such chances when you install

Patterson

Everdur and Copper-Lined Hot Water Heaters

We *guarantee* these heaters not to rust or cause red water. And back of that guarantee is a half-century-old house whose financial responsibility and willingness to make good, if necessary, are beyond question.

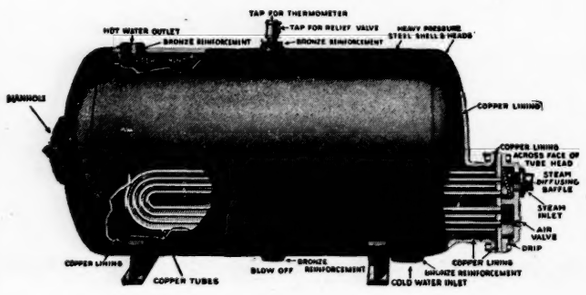
Patterson Copper-Lined Heaters installed more than a quarter of a century show no deterioration. They are practically everlasting.

Patterson Heaters are also made with shells of pure copper, stainless steel, nickel clad steel and steel.

Write for Catalog

THE PATTERSON-KELLEY CO.

105 Burson St., East Stroudsburg, Pa.



Edge Moor Iron Works, New York, has appointed **Russell T. Kernoll** chief engineer of welded fabrication. He was formerly connected with the engineering department of M. W. Kellogg Co., and prior to this was for many years associated with Struthers-Wells Co.

Foster Wheeler Corp., New York, has appointed **W. L. Martwick** general sales manager. He has been connected with the company since 1926, when it acquired the Aero Pulverizer Co., of which he was president. Previous to his appointment he was manager of the steam division.

Frigidaire Div., General Motors Corp., Dayton, Ohio, is to handle all the manufacturing, engineering and allied operations dealing with the actual manufacturing of Frigiaire refrigeration products. Under the set-up of the newly organized **General Motor Sales Corp.,** all refrigeration sales operations will be carried on by **Frigidaire Div., General Motors Sales Corp. E. G. Biechler** remains general manager of each of the units. No personnel changes are involved.

F. Jehle

Hoffman Specialty Co., Stamford, Conn., has appointed **Ferdinand Jehle** director of its Research Laboratory, which was opened last October. Mr. Jehle comes to Hoffman with a background of research engineering covering the past 26 years. The laboratory has just been completely equipped to develop and test devices for use on radiator heating systems.

Kelvinator Corp., Detroit, Mich., has appointed **W. E. Saylor** sales promotion manager. Mr. Saylor has been associated with the electric refrigeration industry for the past 12 years. For the past six years he has been a member of Kelvinator's advertising and sales promotion department. During the past year Mr. Saylor has been serving as manager of operations in the advertising department.

The Lincoln Electric Co., Cleveland, Ohio, has appointed **William F. Fischer** to the sales staff of its San Francisco office, 866 Folsom St.

May Oil Burner Corp., Baltimore, Md., has appointed **A. E. Duncan** chairman of the board, and **Edward E. Yaggy, Jr.,** president. **Ramon Wyer** has been named vice-president in charge of production, and **A. Klotzman** vice-president in charge of engineering. **P. J. Jacobson,** formerly divisional manager at Chicago, has been appointed vice-president in charge of sales. **E. Lyell Gunts** is director of sales promotion. **W. E. Tolley** and **Eli Frank, Jr.,** are treasurer and secretary, respectively.

The Mercoid Corp., Chicago, has opened a branch office and warehouse at **3137 N. Broad St., Philadelphia. M. K. Stauffer,** with the assistance of **John Jex, Jr.,** will be in charge.

National Radiator Corp., Johnstown, Pa., has appointed **W. B. Montague** advertising and sales promotion manager. Mr. Montague goes to National from Surface Combustion Corp., at one time having been sales promotion manager of the Delco Appliance unit of General Motors.

Norge Div., Borg-Warner Corp., Detroit, announces that **Howard E. Blood** has been appointed executive vice-president of all the divisions of Borg-Warner. Mr. Blood will also continue in the position of president of the Norge Division, a position which he has held since the acquisition of Norge by Borg-Warner Corp. in 1929, and of the Detroit Vapor Stove and Detroit Gear and Machine Divisions.

Patterson-Kelley Co., E. Stroudsburg, Pa., has moved its Philadelphia office to **1700 Walnut St.** from 2402 Market St. **T. J. Kauders,** associated with the Chicago office for the past 11 years, is in charge of the Philadelphia office, and will have associated with him **C. P. Sanville.**

Republic Steel Corp., Cleveland, Ohio, has appointed the **Byrd Plumber's Supply Co.,** Cleveland, jobber of Republic steel pipe.

THE DEPENDABLE CHOICE OF ENGINEERS, ARCHITECTS AND HEATING CONTRACTORS . . .

AEROFIN
Heat Exchange Surface
PROVED PERFORMANCE

MORE Aerofin heating and cooling surface is used than any other type because Aerofin consistently meets the most exacting demands of engineers, architects and heating contractors who cannot afford to take chances on performance.

They know that Aerofin performance has been *proved* in thousands of installations. They know that they can specify it with confidence, secure in the knowledge that it will live up to its reputation as the most advanced type of heat-exchange surface on the market.

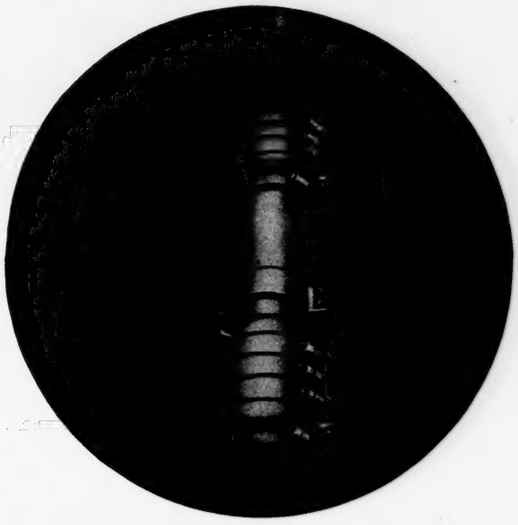
There are many reasons for Aerofin's superiority. For example—Aerofin's crown orifice in heating units prevents scale clogging. Aerofin's centrifugal header in direct expansion units assures rapid and even distribution of refrigerant through the coils with a minimum number of expansion valves. Aerofin's removable header on water units permits easy cleaning of tube interiors.

These are exclusive features in Aerofin which have earned and held the confidence that it enjoys.

Why not start 1937 by specifying Aerofin on your next job? A complete line of equipment for heating and cooling is at your service. Our home office in Newark or any of our branch offices will gladly send descriptive literature or render prompt, effective technical cooperation.

AEROFIN is sold only by Manufacturers of Nationally Advertised Fan System Apparatus. — List upon Request

AEROFIN CORPORATION
850 Frelinghuysen Avenue
Newark, N.J.
Chicago Detroit New York Philadelphia



Why Industry Prefers EXPANSION JOINTS
made by
E. B. BADGER & SONS CO.

1 they are engineered by those who have studied pipe line expansion problems for many, many years.

2 they are fabricated by the concern which has brought out a number of important manufacturing or operating improvements since this type of joint was first used.

Industry prefers these BADGER JOINTS because it realizes that a joint is no ordinary accessory or supply. The joint has to serve in a vitally important place and fulfill a vitally important function. Industry wants to be sure that the joints bought are "engineered" to properly take care of pipe line expansions and have ample factor of safety.

JOINTS by E. B. Badger & Sons Co. of Boston meet all these requirements—100%.

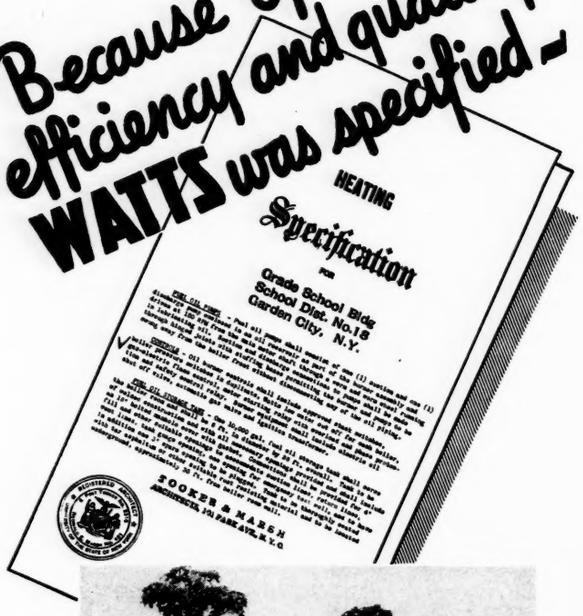
• •

One of the latest developments by Badger Engineers is Directed Flexing. By means of this design, flexing is progressively controlled at all times and flexing stresses are distributed. Both welding and flanged end joints are now made with the Directed Flexing feature which is exclusive with BADGER JOINTS.

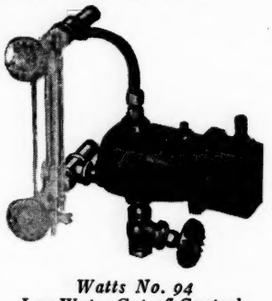
E. B. BADGER & SONS CO.
75 Pitts Street, BOSTON, MASS.
Agents in Principal Cities

BADGER EXPANSION JOINTS

Because of efficiency and quality WATTS was specified—



Grade School Building
District No. 18
Garden City, New York



Watts No. 94
Low Water Cut-off Control.

Modern school and public building architecture and planning recognizes the vital need of Boiler Low Water Cut-off Control. As in this specific case at Garden City, Long Island . . . Tooker & Marsh, the architects; Albert Fentzlaff the Consulting Engineer; and the T. G. Egan Refractory Company the contractors, Watts products are given precedence.

If your acquaintance with the Watts Line is limited . . . we suggest you let us have our field representative call. In the interim, send for the New, No. 37, twenty-page Watts Catalogue just off the press—illustrating and describing the complete line—the largest line of its kind in the world. Also send for a copy of the New No. 37A condensed Catalogue and Price Sheet.

WATTS REGULATOR COMPANY
LAWRENCE, MASS.

Shell Union Oil Corp., 50 West 50 St., New York, eastern affiliate of Shell Petroleum Corp., has appointed **Dr. R. T. Goodwin** fuel oil manager. Doctor Goodwin was formerly manager of Shell Petroleum's fuel oil department, and has been associated with that company since 1932. Previous to this time he was sales manager of the petroleum division of the Dorr Co.

J. L. Minner, formerly assistant manager, has now been appointed fuel oil manager of Shell Petroleum. He has been connected with the company for 11 years, serving as manager of the shipping and supplies department, and at one time assistant manager of the tank car sales department.

H. A. Thrush & Co., Peru, Ind., has appointed **L. V. Cressy**, 817 Poydras St., New Orleans, as its direct sales representative covering Louisiana and the southern part of Mississippi. **F. W. Bartling** has been named direct sales representative in Cincinnati covering Kentucky and the southern part of Ohio. Mr. Bartling was formerly connected with the Cincinnati branch of American Radiator.

Warren Norge Co., New York, has appointed **A. D. McNeilly** as the head of its new heating division. Mr. McNeilly has had several years experience with the American Radiator Co. in New York and in Chicago and is well known in the metropolitan New York area.

NEW CATALOGS

(Unless otherwise indicated the publishers of catalogs will supply copies on request without charge.)

Automatic Temperature Control Co., 34 E. Logan St., Philadelphia, Pa., has brought out a number of loose leaf pages describing its line of industrial controls for regulating temperature, time, level, flow and pressure. Included in these sheets are descriptions of a number of motor-operated controlled valves.

American Radiator Co., 40 West 40th St., New York, has published two standard size bulletins on Ideal automatic coal-burning boilers. The first of these is a 6-page booklet, No. 8421, which lists ratings and other data for handy reference on the Ideal coal boilers. The second bulletin gives general information on these boilers and tells how to select boilers for stokers. It also describes the features of Ideal boilers for stoker firing.

Barber-Colman Co., Rockford, Ill., has published an attractive catalog on its controls for air conditioning. This catalog is standard size, spirally bound, and has 96 pages. It gives a large amount of information on the various types of controls as they are applied to air conditioning. The complete Barber-Colman line used for air conditioning is also described and complete specifications on the various controls are included.

Robert Barclay, Inc., 122 N. Peoria St., Chicago, has published a catalog which describes its line of oil burner, stoker and forced air heating accessories for the automatic heating dealer, service and installation man. The catalog lists a wide variety of accessories and heating equipment; also gives trade dealers' net prices. There are approximately 74 pages in the bulletin.

Century Electric Co., 1806 Pine St., St. Louis, Mo., has published a standard size, 8-page, looseleaf filler on single fan motors. This bulletin describes the advantages of this type of motor over other types, shows the details of construction, and lists the various models available.

Dail Steel Products Co., Lansing, Mich., has published a 16-page heavy paper bound booklet entitled "Taking the Mystery out of Air Conditioning." The purpose of the booklet is to tell the American public just what air conditioning is.

Economy Pumping Machinery Co., 3431 W. 48th Place, Chicago, has published a new handbook entitled "Pump Data" for the solution of pumping problems. The hand-

book is divided into two parts. The first part is made up of descriptions of the various types of pumps which the company manufactures and the second part is devoted to engineering data. A large amount of desirable information on pumps and hydraulics is included in this bulletin. Among the subjects covered in the technical section are pump installations, pipe and fitting data, operating efficiencies and costs, pumps for buildings, and pumps for boiler feeding. There are 233 pages in the handbook of which approximately 105 are in the technical section.

The Emerson Electric Mfg. Co., St. Louis, Mo., has published three standard size bulletins on its fans. The first bulletin, No. X-1949, has 28 pages illustrating and describing the 1937 line of Emerson Electric desk fans, ceiling fans, air circulators, ventilating and exhaust fans. Bulletin No. X-1950 is a 4-page catalog illustrating and describing the line of Emerson Electric Seabreeze fans. Bulletin No. X-1925 is a retailers' sales helps bulletin. It is a 4-page booklet illustrating and describing the fan sales helps for 1937 and gives full information on the Emerson Electric National Advertising.

Goulds Pumps, Inc., Seneca Falls, N. Y., has published its 1937 dealer catalog. Catalog is attractively bound in a stiff cover of green, gray, and black, has 112 pages, and describes the complete line of water systems, hand pumps, miscellaneous power pumps and accessories. Also contains information on computing water requirements, friction loss in piping, and other useful items.

Hobart Brothers, Hobart Square, Troy, Ohio, have published a standard size, 24-page catalog on their new 40-volt simplified electric arc welding method. The booklet contains many illustrations of the various jobs this new welding can handle as well as a complete description of the models available and specifications.

Johns-Manville Corp., 22 E. 40th St., New York, has made available a 20-page booklet, TR-13A describing the J-M Transite flue pipe. Besides a description of the pipe, the catalog contains photographs of actual installations, tables of weights and prices on Transite pipe and fittings. More than 30 detailed drawings showing the method of installing the material are included.

National Radiator Corp., Johnstown, Pa., has published a standard-size, 16-page pamphlet on the National Premier Steel Boilers. This gives the outstanding features and engineering data on its various type steel boilers.

The Oster Manufacturing Co., Cleveland, Ohio, has published a standard size catalog which describes the entire line of Oster Williams pipe and bolt threading equipment and welding equipment. The booklet is attractively bound in heavy paper cover and is made up of approximately 50 pages.

Penn Electric Switch Co., Des Moines, Iowa, has published an attractive booklet entitled Land of Goshen. This booklet commemorates the opening of the company's new and completely modern plant at Goshen, Ind. Included in the booklet is a description of how Albert Penn first got into the control manufacturing business in 1919 and how the company has prospered since then.

Rockwood Manufacturing Co., Div. General Fibre Products, Inc., 1801-2001 English Ave., Indianapolis, Ind. Two standard-size data books describing the multiple groove drives. Data book No. 782 describes the Rockwood groove drives while No. 783 takes up fractional horsepower single groove drives. It is the purpose of these books to make it easy for the purchaser to select a V-belt drive for practically any type installation.

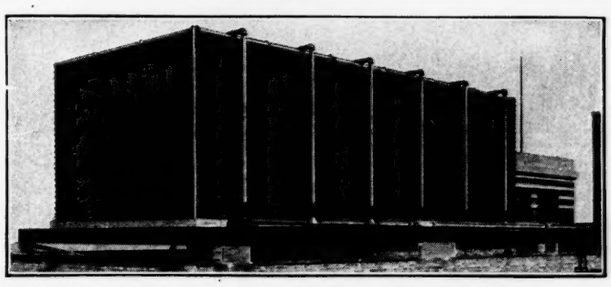
James Campbell Smith, Inc., 16374 Euclid Ave., Cleveland, Ohio, has published a large size, 8-page booklet on the Smith automatic air heater for air heating and air conditioning. The heater is designed especially for oven process use and factory space heating. It consists essentially of a combustion chamber to which coal is fired automatically by a stoker on automatic control. Included in the bulletin are details of construction and operation and data on a typical test.

First Choice of Engineers

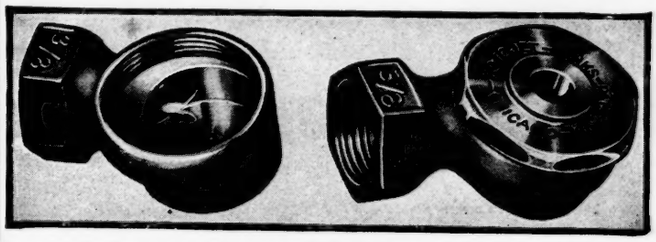
BINKS

Spray

Cooling Towers



BINKS Atmospheric Spray Cooling Towers—built in sizes from 6 to 200 tons refrigeration capacity—as well as Indoor Forced Draft Cooling Towers up to 40 tons capacity, are now used extensively in connection with the rapid march of progress being made in the Air Conditioning field.
BINKS offers a standardized complete shop constructed Tower (with full spray nozzle distribution) for almost every application, as will be evidenced by more than 3,000 Binks Cooling Towers now in operation.
BINKS patented "ROTOJET" Clog-Proof Spray Nozzles likewise are contributing mightily to the increased Air Washing efficiency now in demand.
The Binks line—recognized as being the most complete—includes spray and atomizing nozzles of advanced design for practically every industrial application.
Valuable data on request.



ROTOJET Nozzles furnished in sizes from ¼" to 2½" pipe connections. Nozzle with cap removed shows involute whirl chamber.

A Few of the 3000 Binks Users

Goodyear Tire & Rubber Co.
Armour & Co.
Swift & Co.
Pure Oil Co.
Firestone Tire & Rubber Co.
Brown Shoe Company
Coca Cola Bottling Co.
Brewery Corp. of America
Roosevelt Hotel Co.
University of Michigan
Red Top Malt Extract Co.
Buda Company
Georgia Power Co.
East Ohio Gas Co.
Sheffield Farms Co.
Public Service Co. of Colo.
Great Lakes Forge Co.
Carrier Engineering Corp.
First National Stores
United States Gypsum Co.
Great Atlantic & Pacific Tea Co.

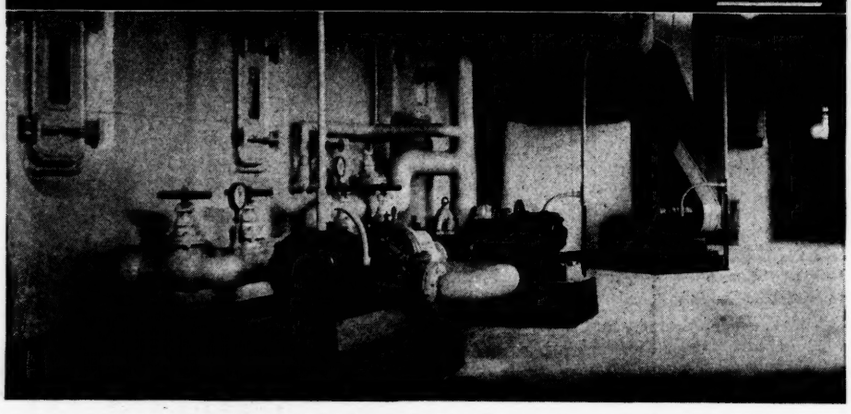
BINKS MANUFACTURING CO.

3114-40 Carroll Ave. Chicago, Ill.

Representatives in Principal Cities

Manufacturers of Complete Water Cooling and Spray Painting and Finishing Systems

THE TIME TO GET STARTED IS *NOW*



Air Conditioning for Next Summer Requires Your Immediate Attention!

1937 will be air conditioning's biggest year! We base this prediction on present activity in our own organization, and on reports received from throughout the industry.

And so we urge immediate action, if you have an office, factory, store, theatre or restaurant to cool and condition for next summer service. Many were disappointed last summer by not having their installations operating on time. Many more may be "out of luck" this year, unless they GET STARTED NOW.

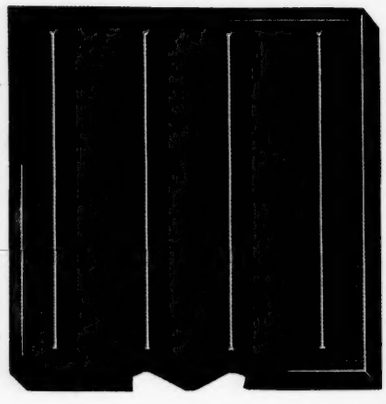
Whether it's complete air conditioning, cooling, unit heating, ventilating, or any one of a hundred different fan applications—we build the required equipment. And all Clarage Units are designed and tested in accordance with accepted Test Codes—manufactured of the finest materials—BACKED BY 25 YEARS' EXPERIENCE. Write us today for any air handling or air conditioning information desired.

SPECIFY CLARAGE for COMPLETE AIR CONDITIONING · VENTILATION · HEATING · COOLING · MECHANICAL DRAFT · FANS & BLOWERS FOR INDUSTRIAL NEEDS

CLARAGE FAN COMPANY - KALAMAZOO, MICH.
Sales Engineering Offices in All Principal Cities

Advantages of somers' WASHABLE "HAIR GLASS" FILTERS

1. *Maximum of dust, soot and bacteria separation*
2. *Requires no adhesive, coating or impregnation*
3. *Washable*
4. *Indestructible in normal service*
5. *Minimum low pressure drop*
6. *Does not rot nor disintegrate in service*
7. *Odorless and non-absorptive*



Somers' Hair Glass Filters have made a splendid record on innumerable air-conditioning and manufacturing installations. Developed in V type and Flat type with choice of No. 1, 2, and 3 Pack, these filters solve the problem of constant filtering efficiency at minimum expense.

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"ALNOR" VELOMETER
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Instantaneous, Direct Reading Air Velocity Meter, 20 FPM to 6000 FPM

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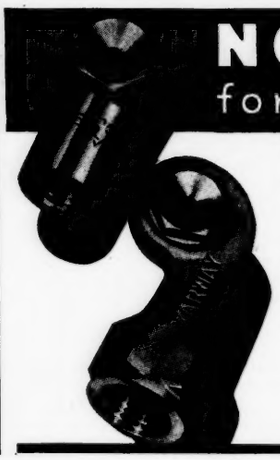
ILLINOIS TESTING LABORATORIES, INC.
143 W. Hubbard St.
Chicago, Ill.

NOZZLES for Air Washing



Yarway Involute Design—with no internal parts or vanes — insures non-clogging trouble-free service. Sizes and types to meet all requirements. Successful installations of Yarway Involute Nozzles in water cooling and air conditioning service total more than 5 million gallons per minute. Write for Bulletin N-615.

YARNALL-WARING CO., PHILA.
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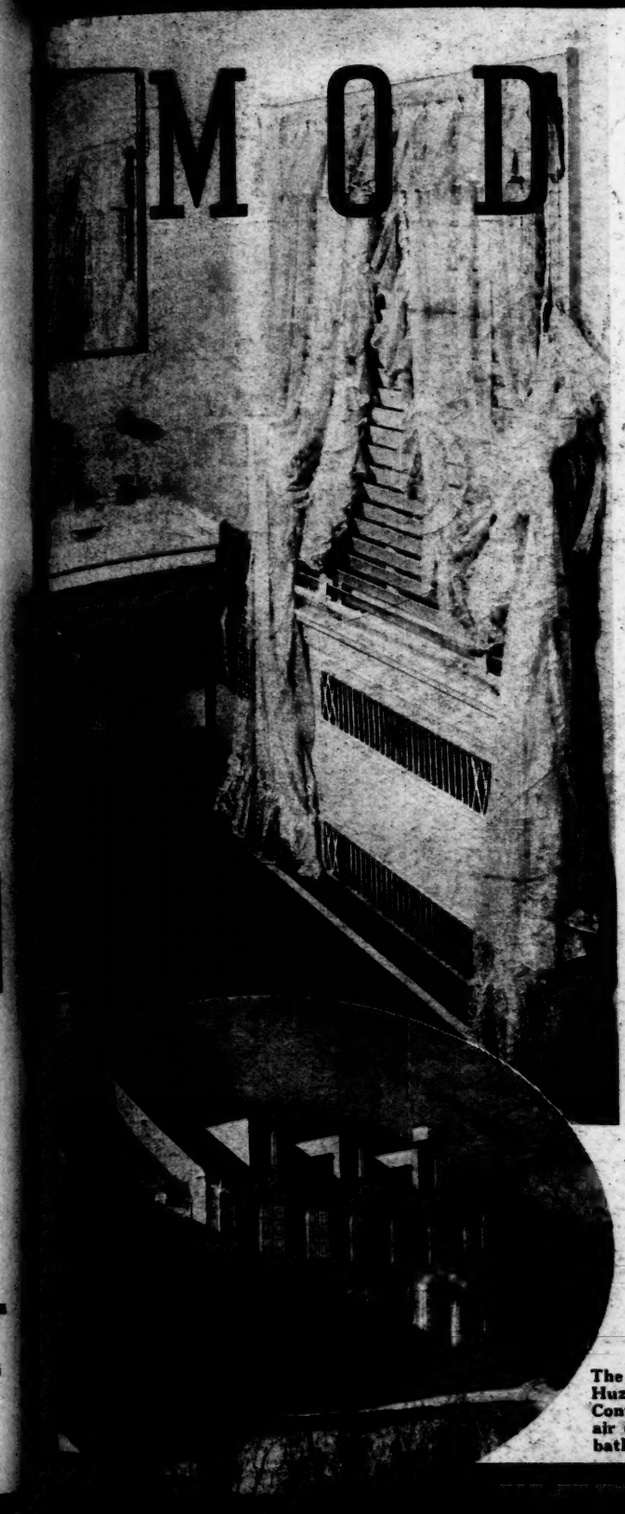

MODINE CONVECTORS

. . . . . a "natural" with

SPLIT SYSTEM AIR CONDITIONING

In air conditioning, heating is the most important single factor. Because of its superior efficiency, flexibility, control and lasting economy, far-sighted contractors are using the split system—a combination of steam (or hot water) direct heating with air conditioning . . . with some of the rooms being heated by conditioned air and others by Modine Convectors.

The "split system" with Modine Convectors is a natural for the contractor—both from the angle of profits and customer satisfaction. Made of enduring copper rather than cast iron, Modine Convectors are more quickly and evenly responsive to thermostatic control . . . far cleaner, faster heating and more economical of fuel.

With hot water systems, Modine superiority is most evident. Only Modine makes a convector ***specifically designed*** for hot water . . . the ratio of prime surface to secondary surface being 1 to 4.

Built into the wall, a convector saves floor space. Details of Modine design are most carefully worked out to this end, while preserving utmost ease of installation.

An important virtue of Modine Convectors is their gentle circulation of room air—helping to distribute humidity from conditioned to non-conditioned rooms—and bridging periods of non-operation of the air conditioner.

And the new Modine Convectors offer the home owner outstandingly beautiful enclosures, and grille designs in almost endless variety, to harmonize perfectly with the style, period and color scheme of the decorations and appointments of even the finest rooms.

Modine offers four types of enclosures: *Concealed* (plaster front, in-the-wall-type); *Recessed* (sheet metal front, in-the-wall-type); *Floor Cabinet*; *Wall Cabinet*.

The Roy Bard residence, Winnetka, Ill. Ralph Huzagh, Architect, Dougherty Bros., Heating Contractors. A complete Modine "split system" air conditioning installation. Interior view shows bathroom with Modine *Recessed* Convector.

See Modine representative for information on Convectors or Air Conditioning. Write for Bulletin 1236 . . see our catalog in Sweet's.